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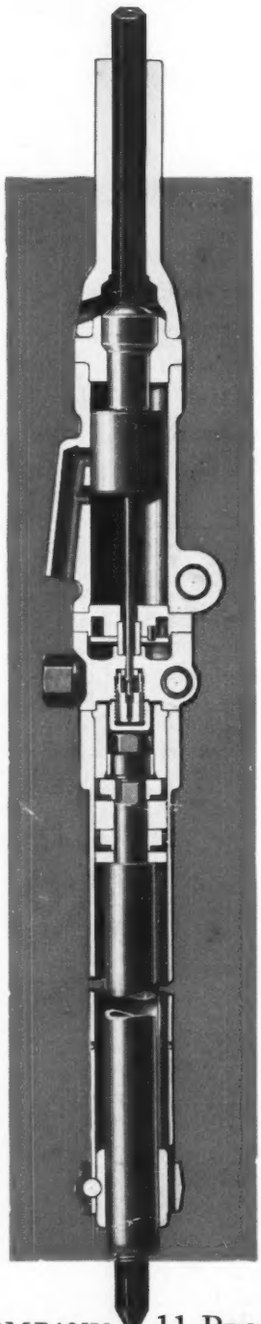

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Volume 127

ENGINEERING AND MINING JOURNAL

Number 11

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New York, March 16, 1929

Mining Engineer's Office Robbed in Butte

THE CRIME WAVE spreads. From Butte comes this appeal: "Somebody stole my *Engineering and Mining Journal* of February 23d and will ask you to kindly send me another one." It is suggested to all mining engineers that they subscribe themselves, and not depend upon helping themselves to some one else's back numbers. The subscriber may miss an issue that we cannot supply, as many issues are out of print a week or two after publication. In no case can we supply a copy after six months. If many copies of an issue are desired, advise us before publication.

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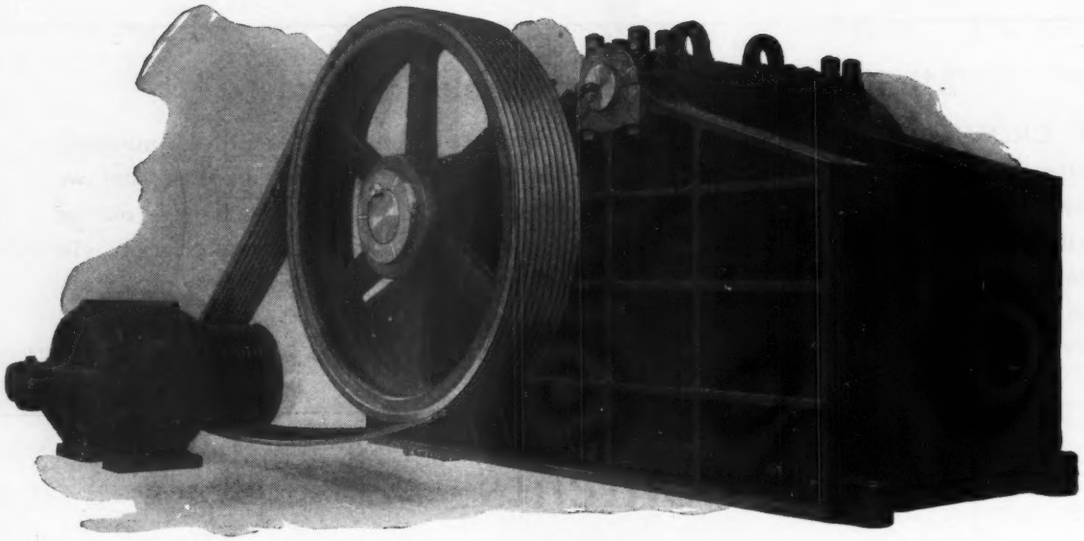

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Geophysical Work in Relation to Locating and Patenting Claims

DISCUSSION of geophysical prospecting in its possible relations to assessment work was given a place on the program of the recent meeting of the A.I.M.E. in New York. More precisely, the conference was called for the purpose of considering the possibility of devising a means of recognizing in the United States mining law the methods and results of geophysical prospecting. The topic was important. Those present did not dispose of it, by any means. It still calls for careful consideration. The conference did not get anywhere with it, as a matter of fact. More often than not the discussion was beside the point. Some interesting things were said, however, by interesting people. Among the latter was Congressman Arentz, who sponsored the so-called (mis-called, he declared) Arentz Bill in Congress, in which were embodied the recommendations of the Ingalls Committee as to the proposed revision of the federal mining law. That bill did not provide for geophysical prospecting, it will be remembered. Those present were reminded by Mr. Ingalls, in a letter read by the chair, that the great development of geophysical prospecting that has taken place within a decade had not been foreseen at the time the bill was introduced.

As the federal law now stands, location on the public land of a mining claim on the strength of favorable results of geophysical prospecting, in the absence of actual discovery of ore in place, would not be considered valid. At the present stage of development of geophysical prospecting, such favorable results undoubtedly would not be considered equivalent to discovery, prior to confirmation by actual drilling or other disclosure of ore. Justly or unjustly, the law makes such discovery a prerequisite to a valid location. No way of getting around this difficulty appears, save through the enactment of special legislation and the amendment of the existing law.

In any discussion of the relationships of geophysical prospecting and the procedure necessary to hold a claim, once it has been located, and eventually to patent it, the outstanding points would appear to be: first, can geophysical field work legally be submitted as the assessment work annually required to be done upon a claim to retain possession of it under the mining law; and, second, if it can be thus submitted legally, how may bona-fide geophysical work performed by competent people be distinguished legally from the bogus variety like that of which the doodle-bug and divining rod operators are guilty? Questions such as these would, at present, be passed upon by the Geological Survey, before any action were taken by the Land Office, according to a member of the Survey who was present at the conference. It is doubtful, however, in the absence of definition by legislation or previous decisions, if such opinion would be final should a case be brought to court. The art of geophysical prospecting is new, and no mass, or maze, of precedent exists to serve as guide in making a decision. Hence the need of special legislation. To clarify and crystallize ideas, thereby to aid in arriving at a proper understanding of the form such legislation should take, conferences such as the one held recently in New York are necessary. Expressions of opinion from readers are invited.

Does the Public Care How Corporations Make Money?

PROFITS OR ETHICS: In which is the stockholder most interested? This matter has been much in the limelight recently, owing to John D. Rockefeller, Jr.'s, fight to oust Robert W. Stewart from the chairmanship of the board of the Standard Oil Company of Indiana. Most people read with considerable satisfaction in the newspapers of March 8 that Mr. Rockefeller had won.

Mr. Stewart, as any one who is at all interested in the matter knows by this time, was one of the star performers in the Continental Trading Company deal which the United States Supreme Court later stigmatized as illegitimate and against the public interest. A part of the profits, said to be $750,000, was finally turned over to the Standard of Indiana company by Mr. Stewart. Another part of the Continental's resources figured in the deal between Harry F. Sinclair and Albert Fall. In the court investigation of all this mess, Mr. Stewart assumed a most belligerent attitude toward the government, which aroused Mr. Rockefeller's ire as a prominent stockholder in that and other Standard Oil companies. Mr. Rockefeller doubtless argued that the companies of this group had been spending a lot of money and effort in cultivating the good esteem of the public in recent years, and that such a palpable flouting of the principles of business morality, with the accompanying publicity, was not to be borne in silence. He accordingly demanded Mr. Stewart's resignation. But Mr. Stewart pointed to the enormous profits that Standard Oil of Indiana had made under his direction, and fought his fight on this ground.

A study of the voting statistics is none too reassuring, for 31,337 stockholders voted for Mr. Stewart's retention against 15,204 for his dismissal; the trouble was they did not own sufficient stock to carry their point. It is amusing to note that 7,901 of the 7,918 employee-stockholders of the company voted in favor of their chief official. Only seventeen men in the organization took the chance of being fired! The smaller stockholders

were evidently satisfied with their treatment at the hands of the company, and were willing to accept dividends without asking too much about how they were acquired. But it is satisfying to know that a man like Mr. Rockefeller, and other business leaders, stood out for something higher, and won. Other business executives who have been trying to make their companies public institutions rather than purely money-making enterprises will be encouraged.

Magnesium Alloys Present Opportunity for Expansion

COMPARISON of the amount of magnesium alloys consumed annually on the Continent with the quantity used by industry in the United States reveals a surprising disparity. As nearly as can be judged from published figures, the present European production and consumption of magnesium metal is approaching, if it has not already exceeded, 5,000,000 lb. annually. In contrast, the output in the United States in 1927 was only 366,400 lb., and the indicated annual increase approximately 13 per cent. At this rate of increase the disparity will certainly continue and probably become greater.

Abroad, magnesium alloys are widely used in the construction of transportation equipment, such as airships, airplanes, motor cars, trucks, and buses. Volume for volume, they are as strong as aluminum alloys and considerably lighter. In some cases the saving in weight effected by employing them may be as high as 20 per cent of the dead load of the entire vehicle. This is a matter that manufacturers of such equipment will not wantonly disregard if they can readily obtain the metal.

None will doubt that the United States is entering upon an era in which air transportation will play an important part. For its proper development such transport will require large quantities of the lighter metals, aluminum in particular. At the same time, wherever magnesium alloys can be substituted to advantage for pure aluminum, the spirit of progress and evolution demand that it should be done. Under such conditions the requisite supply ought to be readily forthcoming.

At the moment, the smallness of the output of magnesium metal in the United States is hard to understand, except that the small demand reflects a lack of appreciation of its advantages by manufacturers. The domestic industry is well protected by a tariff of 40c. per pound plus 20 per cent ad valorem on fabricated shapes. With aviation developing abroad as rapidly as it is, little danger of invasion by metal imported from that quarter is apparent. So far as the immediate future is concerned, Europe appears well able to absorb its own production. This being the case, the infant domestic industry has the United States to itself, with a large potential demand either close at hand or at most not far away, as well as an abundance of raw material with which to meet it. The tardiness of the domestic producers in rising to the occasion offers a puzzle the solution of which is not easily discernible. Comparison of the figures of consumption at home and abroad shows conclusively that the use of magnesium in this country might easily be stimulated. Surely here is opportunity for profit which is being utilized to a negligible extent.

Defining Borderland Material Between Ore and Waste

AN EDITORIAL in the November 24 issue outlined the need for an appropriate term to describe material in the borderland between ore and waste, and suggested "subore" for this purpose. Considerable criticism of the word selected has arisen, because of a suggested implication of physical position rather than of relative economic value. A review of alternative terms and additional comment therefore appears to be in order.

This publication finds "near-ore" unacceptable, for reasons already mentioned. "Minwast," a contraction of "mineralized waste," is too artificial. "Noncom-ore," a contraction of "non-commercial ore," is slangy. "Mineralized rock" is cumbersome and, incidentally, all ore is mineralized rock. "Proxore" means much the same as "near-ore" but sounds somewhat better. "Propore," from the Latin *prope*, meaning near or almost, "infra-ore," and "subgrade-ore," have also been suggested.

The length and variety of the list indicates the interest being shown in the subject, which attitude is appreciated. Additional suggestions will be welcomed. The subject is worthy of the consideration of every mining engineer and metallurgist, for its solution will have a bearing on the clarity of the technical literature of the future. *Engineering and Mining Journal* maintains an open mind on the question and invites the opinions of its readers, so that a true cross-section of professional opinion may be ascertained. If "subore" is not the most appropriate term, another will be adopted and used consistently.

Organisms as Guides to Copper Ore

IN A RECENT ISSUE we commented on the wide distribution of copper in plant and animal tissue and discussed the metal's rôle in human metabolism. Inasmuch as it is found in the livers of numerous animals, in human and cow's milk, in almost all vegetables, in most insects and in many marine animals, one may assert with confidence that the inclusion of minute amounts of the red metal in food is not harmful. In fact, investigations have indicated the value of copper as a remedy for anemia—owing, perhaps, to an indirect catalytic action—and have suggested that it is an essential body element.

The January issue of *The Mining Magazine* contains details of an interesting research, by Mr. C. H. White, of San Francisco, who points out that though copper in small amounts is not harmful to organic life, any considerable quantity of it in mineralized outcrops will inhibit plant growth and consequently make conspicuous the copper-bearing areas in forested regions. Such bare spots have aided prospectors—in the Belgian Congo, for instance. Elsewhere, certain plants seem to thrive on coppery soil, and serve as sign posts to ore deposits. In Australia, a "copper grass" is mentioned. Birds and algæ may indirectly indicate the presence of copper, and small animals have at times assisted in the search for copper by burrowing underground and bringing samples of ore to the surface.

Also, one is reminded in this connection of the touracos, African birds of brilliant plumage, the red coloration of whose feathers is due to the copper content, amounting to about seven per cent. This is the highest concentration of copper so far reported in vegetable or animal tissue. Whether or not the birds, in their native haunts, had to become habituated to copper-bearing soil, thus in time making a virtue out of a necessity, is unknown, but anyway, they are beautiful birds, thanks to copper.

Economic Results of Standardization Judged to Be Favorable

DOES standardization have the effect of improving processes, technique, equipment? Does it make possible a higher average standard of living? Does it relegate problems already solved to their proper place—to the field of routine, leaving creative faculties free for the problems yet to be attacked? These questions were propounded recently by the National Industrial Conference Board. A research resulted in affirmative answers.

Valid objections to standardization may be adduced, however. It may tend to impede industrial and technical progress by producing stereotyped methods and designs. To avoid this, careful and constant checking against the latest improvements and machinery is necessary. In this connection it is interesting to note that the largest industrial organizations are most active in scientific research which is not incompatible with the adoption of a highly developed system of standardization. New products and processes are being evolved in their laboratories, and new standards adopted. Standardization is therefore a sign of progress rather than of conservatism.

Standardization, the report points out, affects factors other than those of size, quality, and design, or of methods and procedure in a productive business. It is applied, we learn, to the functions of business procedure in all its branches, as in purchasing specifications, distribution methods, transporting and handling, clerical work, finance and communication, always with the immediate aim of economizing material, effort, and time. But, so far as mining company reports are concerned, standardization has made little progress. Variations are frequently superficial, but usually they are truly fundamental. One company includes "operating income" with "investment revenue," under the heading "gross income"; another reports base-metal production in terms of dollars and cents; and a third may show only income from metal sold, making the actual production ascertainable only by intricate mathematical calculations. The number of alternative methods of conveying the same impression seems to be infinite. The annual profit-and-loss statement may be peppered with the meaningless abbreviation "etc."—"depreciation, etc.," "income from metal sold, etc.," "federal and local taxes, etc."—the possible interpretations of which are likewise unlimited.

Industry in general has adopted standardized accountancy. A dislike to change may be the cause of the present status of affairs in the mining industry; but we repeat that uniformity in accounting systems comparable with those established by the technical divisions of the industry is highly desirable. Most of the objections to standardization are untenable. Its advantages are legion.

Delay in Government Publication Again Emphasized

DELAY in the publication of government reports and bulletins is a common cause of complaint. Investigations are not ordinarily made until their current importance is manifest; if the public must then wait an unduly long time before the results are made known, much of the interest is likely to have evaporated, or the data secured are out of date by the time the material is available. The United States Geological Survey and the Bureau of Mines seem to be particular sufferers from this governmental delay, some valuable work not being publicly reported upon for years after it has been consummated. Statistical and news matter, of current interest, for example, such as that contained in the various chapters of the "Mineral Resources of the United States," which is issued annually, is not published until approximately a year after the close of the year under review. The first chapter of "Mineral Resources" for 1927 was not available until September, 1928, and several chapters have not yet been published. Similar instances of delay are noted altogether too often.

Naturally some one is to blame for this condition of affairs. Either the delay occurs in the preparation of the copy or in the printing office. In the investigation conducted before Senator Oddie recently, Scott Turner, Director of the Bureau of Mines, placed the blame on the Department of Commerce and on the Government Printing Office. An insufficient amount of money is appropriated by the Department of Commerce for the printing requirements of the Bureau of Mines, the Bureau of Foreign and Domestic Commerce seemingly being particularly favored at the expense of some of the other bureaus in the department. The second reason appears to be that the Public Printer cannot catch up with his work. He is flooded with a mass of material, a small proportion of which is likely ever to be read but which is printed to satisfy the vanity of its authors. Particularly during the time when Congress is in session is the Public Printer's office a busy one. After the session is over, the night shift is abolished. As a result, Director Turner says the usual delay between the time of sending in the edited manuscript and the publication of the finished job is more than three months. This seems absurd to an editor working on a weekly magazine, and it would seem even more absurd to the editor of a newspaper who has his work in the hands of the public within a few hours. But probably the Public Printer regards it as merely a routine interval of time. Steps should be taken to adjust his point of view. Perhaps the new Secretary of Commerce, Mr. Robert P. Lamont, can not only look into the Bureau of Mines' share of the printing appropriation but can also impress upon the printing office that his publications are not to be sidetracked; that they are oftentimes important as news. Certainly, if the *Congressional Record* can be ready for the mail by 8 o'clock every morning, three months is out of reason for an important bureau paper. In his report for 1928, the Public Printer says: "Undoubtedly the best test of the success or failure of any manufacturing establishment like the Government Printing Office is an analysis of its financial reports," which he then goes on to show are favorable. Prompt supply of the manufactured article is usually considered helpful in promoting such success.

Modern Mining Conditions

. . . demand efficient use of

THE PAPER REPRODUCED HEREWITH, *by Mr. Russell B. Woakes, was recently presented for discussion at a meeting of the Institution of Mining and Metallurgy, in the absence of the author. Mr. H. M. Morgans, who introduced it, drew attention to the two conceptions of compression—isothermal and adiabatic. The nearer that isothermal compression could be approached, the better. Continuing, Mr. Morgans said that compressed air was bound to be uneconomical in use under the conditions in a mine. Starting with 2,000 cu.ft. of air at atmospheric pressure and at 60 deg. F., on compressing to 80 lb. gage the temperature rose to 429 deg. F. and the volume was reduced to 540 cu.ft. On entering the mine it cooled from 429 deg. F. to the temperature of the workings, say 60 deg. F., and the pressure dropped to 40.6 lb. gage. The energy required to compress was 7,554,670 ft.-lb., and the energy remaining in the air after cooling was 3,365,550 ft.-lb., or 44.8 per cent. Thus more than half of the energy was expended in the inevitable cooling. . . . Taking further into account the losses in transmission and in driving an engine, it was fortunate if an over-all efficiency of 18 per cent could be obtained between input to compressor and output of engine. He thought tests had been made on rock-drill plants that gave an over-all efficiency of 6 per cent as between input to compressor and output of drills. . . . In the consideration of transmission efficiency, there was a complication, because air as it dropped in pressure expanded in volume; then it had to go faster through the pipes, increasing the friction loss. . . . The drop in pressure was not a measure of the efficiency—the increased volume must be taken into account. Passing 50 cu.ft. per minute of free air compressed to 60-lb. gage through 100 yd. of 1-in. pipe, the drop in pressure was 2.55 lb. per square inch; if the pipe line were 1,000 yd. long, the drop would be 31.67 lb. Obviously, the length of 1-in. pipe must be kept down. If a 3-in. pipe 1,000 yd. long were used to transmit 2,000 cu.ft. per minute of free air compressed to 80 lb. gage at the delivery end, then the inlet pressure must be as high as 184 lb. per square inch, but even so the efficiency of transmission was 73.4 per cent, which was unexpectedly high. . . . There was no accurate, simple formula for getting at the drop of pressure in a pipe line, but it could be said generally that large pipes were always right; with good re-*

RECENT INVESTIGATION into the efficiency of a compressed-air installation has suggested the subject of this paper. . . . Compressed air as a means of transmission of power for underground service has so many advantages, obvious to the mining engineer, that it seems unlikely that it will be supplanted by electricity or other power sources in the near future. Its employment at present in metalliferous mining is almost universal. It would, therefore, appear reasonable to suppose that installations have reached a high stage of efficiency and that compressed air is delivered to the mine in the most efficient manner. Is this true in the average mine?

Air compressors are designed by experts who have made a close study of efficiency, and these machines deliver compressed air to a receiver or to the mine air main with the maximum efficiency, provided they are correctly installed and maintained, with due regard to the temperature and cleanliness of intake air. This stage, however, is essentially within the province of the mechanical engineer, and although deserving of the closest attention, if maximum efficiency is to be obtained, is hardly within the scope of this paper. The contribution, however, of information and data on these and other important points, directly responsible for very definite and considerable losses in efficiency, should be most welcome to the mining engineer.

On entering the air main the compressed air passes into the specific realm of the mining engineer. Does it in this realm and in its multifarious travels through the mine receive the same close attention and study of efficiencies?

How many mine managers can conscientiously say that their underground air mains would bear the scrutiny of an expert and are delivering compressed air with reasonable efficiency at the working points? It seems reasonable to consider this question under the following headings:

(1) Transmission
(2) Air-driven machines
(3) Pumping
(4) Ventilation

Transmission—Tables are available in the mining engineer's *vade-mecum,* Peele's "Mining Engineer's Handbook," giving much valuable information that can be relied upon and is of the greatest assistance in the design and layout of new lines, but more comprehensive data are surely required regarding the loss by friction in different types of valves, tees, elbows, bends, and old or corroded pipes. The loss in efficiency at a straight-edge

Compressed Air

ceiver capacity in the compressed-air system, variations in pressure were kept down and the unloading device on the compressor acted less frequently. . . . The author mentioned losses in transmission through leaks in pipes. It was extraordinary how many leaks were allowed to go on in a compressed-air system. A leak of compressed air was not aggressive, like a leak of electricity; in fact, it was welcomed rather than otherwise. . . . The Victualic was a good joint, forming a pipe line possessing some flexibility at the joints, while remaining tight. The author wanted particulars of losses in valves, bends, and fittings. It was difficult to say to what these amounted. The precaution was to have long radius bends, pitcher tees, and full-way valves, and to watch the design fittings. . . . In using compressed air in engines, water was the bugbear. There was strong cooling on expansion, so that the temperature was quickly below freezing point, and any moisture in the air solidified and blocked the passages of the engine or drill. If the air were dry, it would not matter how low the temperature became. It was easy to get down to 150 deg. F. on expanding six times, but, if the air contained water, non-expansive, inefficient work was imposed. Starting at 70 deg. F., the freezing point was reached in expanding less than twice. Therefore it was important as far as possible to get water out of the air. . . . Good data on this subject, said Mr. Morgans, were published on drill testing in South Africa by Izod and Laschinger (Journal South African Institute of Engineers, Vol. 12, No. 4, Nov., 1913, et seq.). They found that a 3¼-in. drill took 84 cu.ft. per minute measured as free air, for seven hours out of an eight-hour shift—in stoping. The same drill used in development work took twice the air. . . . It was important to instal and use meters in pipe lines; also to test compressor cutputs. There was an American standard testing apparatus which could be applied to a given compressor month by month to see whether the compressor was maintaining its duty. . . . Mr. Morgans, concluding, reminded his hearers that a useful book on the theory of air compression and distribution as applied to practice is "Compressed Air," by T. Simons (McGraw-Hill Book Company, New York). In "Revue de L'Industrie Minérale" for June 15, 1926, No. 132, there is an informing article in French on compression and expansion of air. The influence of water vapor present is investigated.

aperture is well known to designing engineers, and the closest study of flow lines and air resistance is made in numerous branches of mechanical engineering. It is, I venture to say, a closed book to the average mining engineer, whose air lines and connections, with their many and varied ramifications throughout the mine, are installed at the discretion of the ubiquitous pipe fitter. This individual, in happy ignorance of friction losses, wire drawing, and other technicalities, is generally imbued with the desire to make connections in the minimum possible time, with the minimum amount of pipe cutting and its attendant use of stocks and dies or visits to the threading machine.

The result is the installation of lines of insufficient diameter for the work for which they are required, and the inclusion of numerous unnecessary tees, bends, elbows, and reducers that swell the sum of friction losses to an unbelievable extent. Valves of totally unsuitable design are commonly included in the air line, and flange gaskets may be carelessly cut so as to cause obstructions and thereby friction losses. A realization of such losses in definite figures of pounds per square inch, or cubic feet of free air per minute, would be both illuminating and surprising to the supervisory staff. They can, it is true, be determined to some extent by the installation of a pressure gage at different points in the line, but how many mines spare the time, labor, and supervision for such work? Air-flow meters would give equal if not more valuable information, but are expensive and again entail the expenditure of time and labor that can ill be spared. Such losses individually are doubtless insignificant, but are none the less real, and, in the many miles of air line that in the average mine contribute to the transmission of compressed air, must constitute a figure that would surprise the management.

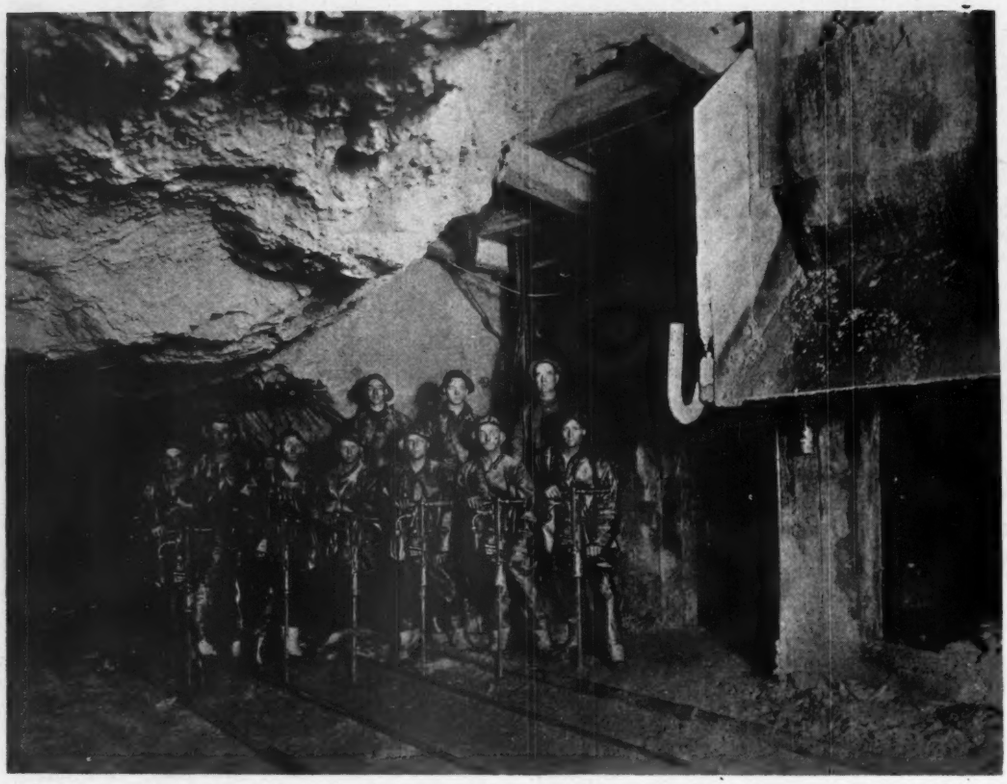
The compilation of tables giving definite information on friction losses for all sizes of pipe fittings at different gage pressures and rates of flow would prove of incalculable value.

Losses from leakage are an equally common and avoidable waste.

On this subject I cannot do better than quote from an article in the Keystone Metal Quarry Catalog by Lee A. Knights, of *Mine and Quarry*.

Losses from Leakage

Very few people fully realize the losses due to leakage of compressed air. A hole $\frac{1}{32}$ in. in diameter will cause a loss of about six cubic feet of free air per minute at 100 lb. pressure. A ¼-in. hole will allow a loss of over 25 cu.ft. per minute, or enough to



Where compressed air is put to good use—a winze-sinking crew at the Dome mine, in the Porcupine district of Ontario.

run a small tool. A ¼-in. hole will allow over 100 cu.ft. per minute to escape, or enough to run a modern rotating hand hammer drill or a stoper. It is seldom that the leakage from a ¼-in. hole would go unnoticed, but a multitude of smaller leaks are frequently allowed, which reduce the total efficiency of the installation to an almost unbelievable extent.

It requires only a simple calculation to ascertain that sixteen $\frac{1}{16}$-in. holes are equivalent to one ¼-in. hole, and in several miles of pipe line it requires the closest attention and supervision to insure that even not more than sixteen small leaks are occurring, or sufficient to run another machine drill.

It is so often the obvious that is passed by without comment or action, that one feels compelled to ask the following question: How many mining engineers are daily passing badly designed air mains and minor leaks, the sum total of whose friction and leakage losses, taken the world over, would constitute an appalling figure?

From personal experience I have found the only practicable solution to the problem of leakage losses to be the employment of one or more men, according to the size of the mine, whose whole-time duty is the stopping of air-line leakages. Payment can be made with a bonus for no leakages located in any one period, or in countries where such is possible a small fine could be enforced for each leakage discovered. Such a system works admirably, and these men will amply repay their cost, in spite of the apparently small amount of work entailed. Divided attention to this and other duties will sooner or later result in neglect of attention to leakages, and the essence of success is undivided whole-time responsibility for this one particular job.

Air-Driven Machines—Modern competition and the many manufacturers of air-driven machines have assured us of the maximum available efficiency in the design of the machine itself. The mining engineer, however, is responsible for the maintenance of this efficiency and for contributing conditions.

Conditions underground can never be expected to equal those on surface, chiefly owing to inadequate lighting, which is probably mainly responsible for many matters that pass unnoticed. Many points, however, are often neglected that can and should receive attention. Such attention will at once be reflected in increased efficiency from the machines, longer life, and a decreased bill for spare parts.

Lubrication—Correct lubrication is as important in a rock drill, air hoist, or pump as in any other machine, and exhaustive tests are carried out by the makers to determine the correct grade of oil for each particular machine. This information is freely communicated to the customer, but is not, it is feared, in all cases adopted. In one instance rapid wear in a machine was directly attributable to the use of unsuitable oil and ceased immediately the correct grade of oil was adopted.

The use of air-line lubricators is undoubtedly a profitable investment, especially where native labor is employed. They insure constant and correct lubrication to moving parts and can be inspected easily by the supervisory staff. Without these lubricators the general practice consists of a flooding of oil at certain periods and little or no lubrication for most of the working time.

Containers for conveying lubricants to the working place underground should be suitably designed so as to collect the minimum amount of dirt and grit, and at the same time transfer their contents with the minimum of waste and spillage.

Care of Machines—Systematic and periodic overhaul of all machines by competent mechanics is so essential that it hardly calls for comment, and in a mine of any size an underground fitting shop for this purpose, if not already installed, will save both time and unnecessary transport of machines.

Faults that are only too common with native labor are:

1. Machines left lying on the floor of the level or stope with ports or inlets unplugged with waste.

2. Additional lengths of air line supplied and connected direct to the flexible hose and machine without first blowing out the accumulated dirt.

3. Flexible hose left lying in dirt, and where it can be cut and damaged.

4. Damage to machine parts due to the use of drill steel that has been carelessly and incorrectly shanked in the drill-sharpening shop.

Pumping—Where pumps are operated by compressed air, the same faults already mentioned, namely faulty pipe lines, both air and delivery, incorrect lubrication, and care of machines, also call for attention. A common and indirect cause of increased air consumption is the leakage of water from an upper to a lower level, resulting in increased consumption of compressed air to pump the same quantity of water, owing to the increased head. If this matter has not been given attention, it is surprising what improvements can be made in a mine of any size. An investigation of this point, especially in levels near the surface, will bring to light many small leakages which can be diverted easily by small dams and pipe lines, these installations effecting definite and lasting economies in compressed-air consumption.

Ventilation—The use of compressed air to produce power underground has resulted also in the advantage of ventilating the mine workings, and thereby has attained great importance in modern mining. The dual purpose which it serves introduces the debatable question—what proportion of the cost of a compressed-air installation, with its many inefficiencies, should be chargeable direct to ventilation in the cost sheet?

Apart from the general improvement in underground air conditions gained by the use of compressed air as a producer of power, the employment of jets or nipples for the local ventilation of development dead ends is common practice. This method of ventilation, in spite of its inefficiency, is so convenient and so easily installed that it will doubtless always be practiced for the purpose of clearing smoke and fumes after blasting. A study of tables giving the theoretical volume of free air in cubic feet per minute that will flow through orifices of different diameters will give valuable information on this subject, and emphasize the heavy consumption of air that is entailed unless nipple apertures are controlled both as regards size and time of operation.

The points raised in this paper which tend to inefficiency in the use of compressed air in mining may be summarized as follows:

Transmission

1. Ill-designed pipe lines with inclusion of unnecessary fittings.
2. Leakage losses.

Air-Driven Machines

3. Incorrect lubrication.
4. Lack of systematic and periodic overhaul.
5. Air ports unplugged when machine not in use.
6. Pipe lines not cleared of dirt before use.
7. Unnecessary damage to flexible hose.
8. Use of incorrectly shanked drill steel.

Pumping

Items (1), (2), (3), and (4), already specified, apply to this also.

9. Failure to collect water present at higher levels.

Ventilation

10. Control of nipples.

Modern conditions demand an increasing study of efficiencies, and no measures that will increase efficiency can be ignored. The subject of this paper does not receive the attention it deserves, either in the education of the young engineer or in the actual field of practical mining.

Heat Treatment of Tool Steel by Electricity

A PAPER on the use of electricity in the heat treatment of metals, written by A. N. Otis, was a feature of the meeting of the Western Metal Congress held recently in Los Angeles. Although it is true that electricity is the most expensive fuel on a heat unit basis, pointed out Mr. Otis, it is also true that, solely on a heat basis, furnaces often can be maintained at the working temperature, and work done, at a lower cost with electric heat than by burning fuel. For example, the ordinary box-type furnace used in tool rooms is required to stand idle a large part of the time, but must always be maintained at temperature and ready for use. Comparatively little of the heat is actually used.

The losses from electric furnaces are small, owing to efficient heat insulation, whereas the losses from fuel furnaces are relatively large, owing to flue losses. An electric furnace 18 in. wide by 36 in. long will require 20,500 B.t.u. per hour to maintain its temperature at 1,600 deg. F., against 104,000 B.t.u. for a gas furnace of the same size.

Carburizing furnaces are sometimes required to hold the charge constant for 20 or 30 hours or more, after reaching temperature, and the small losses of electric furnaces make them economical for this service also. An electric furnace 3 ft. wide by 6 ft. long will require 51,000 B.t.u. per hour to maintain it at a temperature of 1,600 deg. F., whereas a similar gas furnace will require 240,000 B.t.u. Electrically heated furnaces of the rotary hearth and pusher type are well adapted for carburizing on a large scale, many of them being in daily use. The power consumed for heat-treating in these types of furnaces is about 200 kw.-hr. per ton, and for carburizing, 400 to 600 kw.-hr. per ton.

Electric furnaces are used extensively for annealing tool steel and alloy steel bar stock, for which careful work is essential. Accurate temperature control and uniform heat distribution in the furnace are necessary during the long holding period, following which the material must be cooled slowly and uniformly throughout the furnace if the desired results are to be secured,

The tool steel stock is usually packed in boxes for annealing to avoid decarburization, but for much of the other stock a slight decarburization is not objectionable, so the boxes can be dispensed with, saving their cost and the energy required to heat them, as well as permitting much more efficient loading of the furnace, with consequently greater output and lower heat consumption per ton. With boxes, 370 to 400 kw.-hr. is required per net ton of stock annealed. Without boxes about 300 kw.-hr. per ton is required, depending on the cycle and size of furnace. The holding capacity is doubled when the boxes are omitted.

Responsibility for Safety in Mines

Must Be Shared by All Officials and Employees—Not Delegated to Any One Person

SAFETY PROGRESS is measured by the interest displayed in accident prevention by the management. Measured by this yardstick, safety, it is safe to say, is making progress in the metal-mining industry because of the increased interest in the subject during the last few years. Although a marked improvement is not evident when the accident statistics of the industry are studied, hopes for the future are warranted because of the initiation of measures for installing safeguards where necessary; providing proper supervision; enforcing discipline, and last but not least, educating employees in safety. All this is bound to bring about a better safety record.

AS THE use of electricity increases, the fire hazard will mount unless more precautions are taken. . . . Many mines are replacing trolley locomotives with storage-battery locomotives to avoid the fire hazard and the contact danger to men and animals. . . . More fires occur in metal mines than in coal mines. . . . Iron and lead-zinc mines have better safety records than copper, gold, and silver mines. . . . Accidents from explosives can and should be reduced.

I am glad to announce that the year 1927 (the last year for which statistics are available) showed a marked improvement in the records of the metal-mining industry in the United States. According to the statistics recently released by the Bureau of Mines fewer deaths and injuries from accidents occurred in 1927 than in 1926. The death rate was reduced from 3.47 per thousand of three-hundred-day employees in 1926, to 3.10 per thousand in 1927. The non-fatal rate was reduced from 245 to 222 per thousand employees. In the latter year the industry employed 119,699 men, who worked an average of 284 shifts. The number of men killed in the entire industry was 352 and the number injured was 25,133. An injury is considered as such when a man is disabled for more than the day on which the accident occurred.

We can congratulate ourselves on the improved record in 1927 over 1926, but it is still not so good as the record of 1925, when only 2.99 per thousand of three-hundred-day workers were killed. So far this record is the best in the history of the industry and a mark to shoot at in 1929.

THE plan advanced for the education of the vast army of workmen employed by the metal-mining industry to make them safer workmen is going to take time and patience. And when I made the statement that the industry is making progress in that direction, I based it not on a year-to-year comparison but on the records over a span of years. As an illustration to prove the statement of improved safety conditions in the industry I will again call on the Bureau of Mines statistics. These statistics disclose the fact that the fatality rate per thousand of three-hundred-day workers has decreased steadily, with a few exceptions, from 4.45 in 1911 to 3.11 in 1927. The year 1911 had the worst record in the seventeen-year period. The best record was for 1925. The exceptions above quoted—which stand out as black marks—were years in which a catastrophe, usually a mine fire, occurred. For instance, the North Butte fire in 1918 and the Argonaut fire in 1921.

The copper mines employed 30,724 men in 1927 and killed 111. Gold, silver, and miscellaneous metal mines employed 30,461 men and killed 114. Iron mines employing 33,386 men killed 73, but injured less than half as many as the other two groups. Lead and zinc mines employed 12,499 men and killed 28. These figures disclose the fact that the copper group and the gold and silver group had about the same rate of fatalities. The iron and lead-zinc group were relatively about the same, regarding the number of fatalities, but their record was considerably better than the copper, gold, and silver groups.

DURING the ten-year period 1917 to 1926, there was a total of 4,551 fatalities and 330,000 non-fatal accidents in and about the metal mines. Sixty-nine per cent, or 3,125 of these fatalities, occurred underground.

Causes of underground accidents are divided into fifteen major classifications, and that the manager may intelligently initiate a campaign for the reduction and elimination of accidents he should know the major causes and attack them first. I have used the words "the elimination of accidents" knowing that this will be questioned by many who still hold to the old theory that as long as we mine ore we will have accidents. This probably will be true just so long as the men whose responsibility it is to eliminate them assume that unfortunate attitude. But before the record of entire elimination can be reached, the aim of owners, operators, and officials should be for the material reduction in all classes of accidents.

Assurance that accidents in metal mine operations can be reduced to almost the vanishing point can be sub-

A paper presented at the First Rocky Mountain Safety Conference, by John T. Ryan, vice-president and general manager of the Mine Safety Appliance Company.

stantiated by the actual accomplishments of several companies the managers of which have had the will and determination to do it. One of the most striking illustrations is the record of the copper mines of the Phelps Dodge Corporation, which includes the mines of the Copper Queen, Moctezuma, and Morenci branches. This company reduced the lost-time accidents from 2,386 in 1924 to 82 for the first six months of 1928, and the rate per thousand shifts from 1.047 in 1924 to 0.072 in 1928. A full description of the methods employed by the Phelps Dodge Corporation in accomplishing this record is contained in a paper presented by Cleveland H. Dodge before the Mining Section of the National Safety Council last October at the New York meeting. Every mining executive interested in safety should read this article. Mr. Dodge in his paper struck the real keynote in the following statement: "It became evident that our past weakness was in placing the responsibility for safety on a few special men, rather than considering it as a major part of our operations, in which the responsibility would fall on all operating officials."

The National Safety competition conducted by the Bureau of Mines and sponsored by *The Explosives Engineer* magazine reveals many safety records in the year 1926. Two metal mines and fourteen quarries operated the entire year without a lost-time accident. This record is rather a revelation in the industry, as only the relatively large mines participated in the contest.

IN ANALYZING the causes of the 3,135 underground metal-mine fatalities that occurred in the ten-year period 1917 to 1926, it is found that 81.6 per cent fall in five of the fifteen major classifications of causes as follows:

Cause:	Fatalities
1. Falls of rock or ore from roof or wall	1,301
2. Explosives	432
3. Haulage	314
4. Falling down chute, winze, raise, or stope	284
5. Mine fires	229

The fall of rock or ore which took such a large toll of lives is the principal cause of fatalities and non-fatal accidents and is considered the most difficult to eliminate or to reduce materially. However, a great deal can be accomplished in this direction by giving more attention to the timbering, by closer and more effective supervision, and lastly, and of equal if not greater importance, by a well-directed campaign of safety education for the face workers.

As to the second classification, explosives, little can be said in the way of excusing this tremendous loss of lives, the second highest in the industry. These accidents can and should be reduced by improved blasting practices and more alert supervision in the handling and use of explosives. Consideration should also be given to the adoption of electric firing where it is not used.

Improvement in the haulage accident classification can be brought about by improved tracks, haulage equipment, and safety education.

THE last classification, that of mine fires, is at present given scant attention, except by a few companies which have experienced disasters or expensive fires. Few realize that fires occupy fifth place in causes of fatalities in metal mines. We look upon fires as a greater hazard of coal mining because the combustible material is already there to fire. But as a matter of fact more fires occur in the metal mines than in the coal mines. Fortunately few of them cause loss of life; yet there are enough to class this as the fifth greatest cause of fatalities, with the total loss far greater than in the coal mines, which employ over four times the number of men. That this hazard is not generally appreciated is attributable largely to the fact that we are prone to look upon metal mines as being non-combustible. They should be, but they are man-made combustible by material taken in and left there, with not enough precaution taken to prevent ignition. The combustible material taken into and left in a mine, which is the source of many mine fires, is hay, straw, manure, explosive boxes, explosive wrappings, sawdust, partly used carbide, and trash in general.

The principal causes of metal-mine fires are open lights, electricity, smoking, and blasting. Open lights have been by far the most serious fire hazard. At present several large metal-mining companies are trying electric cap lamps to eliminate this hazard and improve the safety and efficiency of their workers.

CLOSELY following the open lights comes the rapidly increasing fire hazard of electricity. As its use increases, this fire hazard is going to mount unless more precautions are exercised. The trolley wire coming in contact with timbers, often owing to falls, is the most prolific source of this class of fires. Many metal mines are replacing trolley locomotives with storage-battery locomotives to eliminate this fire hazard and the contact hazard to men and animals.

Fortunately, fires cause few non-fatal accidents, for men usually either escape or are asphyxiated by carbon monoxide gas. At least 95 per cent of the fire fatalities are caused by the presence of carbon monoxide. A very small fire can produce a large quantity of this deadly gas. It should be emphasized that the fire is only an indirect cause, and the gas the direct cause, of death. The indirect cause should be eliminated as much as possible, but the direct cause should be guarded against by proper positive ventilation means, escape ways, and making available to the men self-rescuers that will provide ample protection against carbon monoxide, thus enabling the men to escape to the outside through the gases.

Referring now to non-fatal accidents in the industry, eighty of which occur for every fatality, the most effective means found for reducing them is a thorough campaign for safety education, backed seriously and effectively by the management. Installing such safety devices as safety hats, safety shoes, protective leggings, and goggles cuts down the head, foot, hand, and eye injuries that amount to about 85 per cent of the total of non-fatals.

IN CONCLUSION, I want to emphasize again that progress has been made in accident reduction in the metal mines during the last seventeen years, but there is much to be done, and the rate of improvement must be speeded up to keep pace with other industries. And I want to restate Mr. Cleveland Dodge's creed that safety must begin with the highest official of the company and it must be considered as a major part of the operations. All operating officials, and more particularly the foremen and shift bosses, must recognize their responsibility to safety.

Safety must be popularized, dramatized, and humanized.

Detailed Information on Construction and Cost of

FIG. 1—COMBINED STAFF HOUSE AND DORMITORY AT A METAL MINE IN NORTHERN ONTARIO. CAPACITY, 50 MEN. INSULATED FIRE-SAFE AND SOUNDPROOF WOOD-FRAME BUILDING.

SATISFACTORY HOUSING FACILITIES AT A M

. . . Provides Opportunity for Improvements in Industrial Relations

In this the concluding installment of as valuable and suggestive a series of articles as "Engineering and Mining Journal" has ever been privileged to publish, the authors discuss in considerable detail the actual methods of construction used in the application of their ideas in a typical mining camp. From a study of these articles the reader will see that every factor of direct and indirect influence on the economy of construction and efficiency of result has been considered. The net result is a pleasing appearance, variety in form, stability and permanence of structure, and an appreciable saving in cost, initial and maintenance. Much of the net result is due to the liberal use of wet-poured gypsum insulation and the adoption of wall board in place of lath and plaster. This change in customary practice insures the quiet during sleep hours that is so essential to the efficiency and contentment of three-shift workmen. A reduction of fire hazard to negligible proportions is accompanied by so efficient a use of fuel that upkeep costs are reduced in the attainment of ideal indoor temperature conditions and adequate ventilation in winter as in summer. No greater step could be made in the improvement of industrial relations than the wide adoption of so sensible a plan for the construction of housing and community buildings. Mr. Clement is a mining and constructural engineer well known in the United States and in Canada. Mr. James Govan is a Toronto architect and author of wide experience.

ADDITIONAL living accommodations at a developing mining property in northern Canada employing at that time 160 men in operation and construction were needed. One of the authors of this article, manager of the enterprise, had realized that dwellings and other wooden buildings as usually constructed in such camps were not completely satisfactory in that climate. The manufacture of gypsum insulating material had been started in Ontario, and after consultation with the consulting architect, who had been retained on the general designing of the buildings and who collaborates in this paper, it was decided to use that material in the buildings then under consideration, and to alter structural details and methods of use, attempting to reduce the amount of material and labor, and thus adjust the cost to the comparatively small budgeted outlay that was thought advisable to allot for the purpose at the development stage of the property. The results exceeded expectations, and several requests have been made for details by other engineers and operators. It is desired to give due credit to E. E. Nelson, who was superintendent of construction at the time and in charge of detail designing, and to J. Madden, carpenter foreman, for co-operation and assistance during the designing and construction stages; also to Harries, Hall & Kruse, town-planning consultants, of Toronto, who made the townsite layout and building placements.

The features that differ from the usual may be enumerated as follows:

1. The structures were set on creosoted cedar posts, without cellars or concrete walls, resulting in a considerable reduction of cost.

2. They were designed so that stiffness is provided by the inside wall and partition coverings, using ⅜-in. wall board, which permitted the omission of the usual single- or double-board sheathing, and resulted in a further reduction of material and labor.

3. A 2x3-in. studding was used extensively instead of the usual 2x4 in., and 2x4-in. studding instead of 2x6 in., reducing the lumber cost and providing the thickness of insulation considered advisable: 2¾ in. in the outside walls of the cottages, 3¾ in. in dormitory outside walls, and 2¾ in. in dormitory partitions. In the roofs of the cottages and the dormitory the insulation is 3¾ in. thick. The fractional thickness is due to the fact that commercial sizes of lumber run about ¼ in. less than nominal dimensions.

4. Wet-poured gypsum insulation (Insulex in this instance) was used for protection from heat and cold, making the buildings fire-safe, and providing sound-proof partitions in portions of the dormitory.

5. Special details were developed, notably at the wall plates and around doors and windows, to provide for pouring the insulation after the interior wall board had been nailed in place, and to insure the filling of all portions of the space.

6. A different method of applying the insulation from that in use at the time was devised. The outside covering was nailed on the studding, and absorbent paper and wall board were nailed on the inside of the walls and on both sides of partitions. The insulation was dropped through the specially designed wall plates and through the roof. This obviated the necessity of the usual interior form work, and greatly reduced the labor cost of placing the insulation.

The buildings were planned to conform to the principles outlined in former articles of this series. Winter construction was unavoidable, the insulation in the largest building being poured at temperatures as low as 20 deg. F. below zero, with the roof insulation placed in a snowstorm, without heat in the building.

Five cottages were built at the time, on lots 50x150 ft., these being shown on p. 268 of the Feb. 16 issue and in Figs. 4 and 5, p. 436. They are all of one type and plan, with small differences in entrance porches and ridge lines. The inclosed volume is 11,900 cu.ft., the volume to be heated with all doors open is 6,300 cu.ft. for the lower floor and 2,800 cu.ft. for the upper floor, a total volume to heat of 9,100 cu.ft. They are 33 ft. long and 24½ ft. wide, with four rooms and bathroom on the first floor, and two sleeping rooms and a large storage room on the second floor. All rooms mentioned are completely finished. The rooms are large for this type of cottage, especially the living room, which is 12x18½ ft. Commendable features of arrangement are the large amount of closet and storage space; the location of the bathroom on the first floor, separated from all but one room by two walls; an entrance hall with space for hanging outside garments; the small interior hallway, allowing entrance to any room or the bathroom from any other room, and the nearly central stairway, which, with the hallway, gives an even distribution of heat to all the rooms.

FIG. 3—INTERIOR HALLWAY OF THE STEVENSON MEMORIAL HOSPITAL, AN EXTERIOR VIEW AND PLAN OF WHICH WAS SHOWN IN A PRECEDING PAPER. NOTE LIGHTING THROUGH DOUBLE-GLASS WINDOWS, AND ACOUSTIC PLASTER ON CEILINGS AND FRIEZE TO ABSORB SOUND VIBRATIONS.

All first-floor rooms have full thickness birch or maple floors laid over a 1-in. subfloor with asphalt paper between. The second-story rooms have matched jackpine floors. The trim of the living room and entrance hallway is clear fir, stained a golden oak, and the other trim throughout is clear white pine painted two coats. All walls and ceilings are ⅜-in. gypsum board nailed directly on the 2x3-in. studding, with a layer of absorbent paper between. Joints in the board are concealed by smoothing over with gypsum joint filler. The walls of the first floor rooms are painted with a hard-surface varnish-base paint, and stippled to give a desirable surface. Ceilings on the first floor have a flat-tone paint of a lighter shade; the walls and ceilings of the second story are calcimined.

The cottages are painted outside with two coats of a weather-resisting

FIG. 2—COMMON LIVING ROOM IN THE DORMITORY SHOWN IN FIG. 1.

A MINING PROPERTY

By HARRISON E. CLEMENT *and* JAMES GOVAN

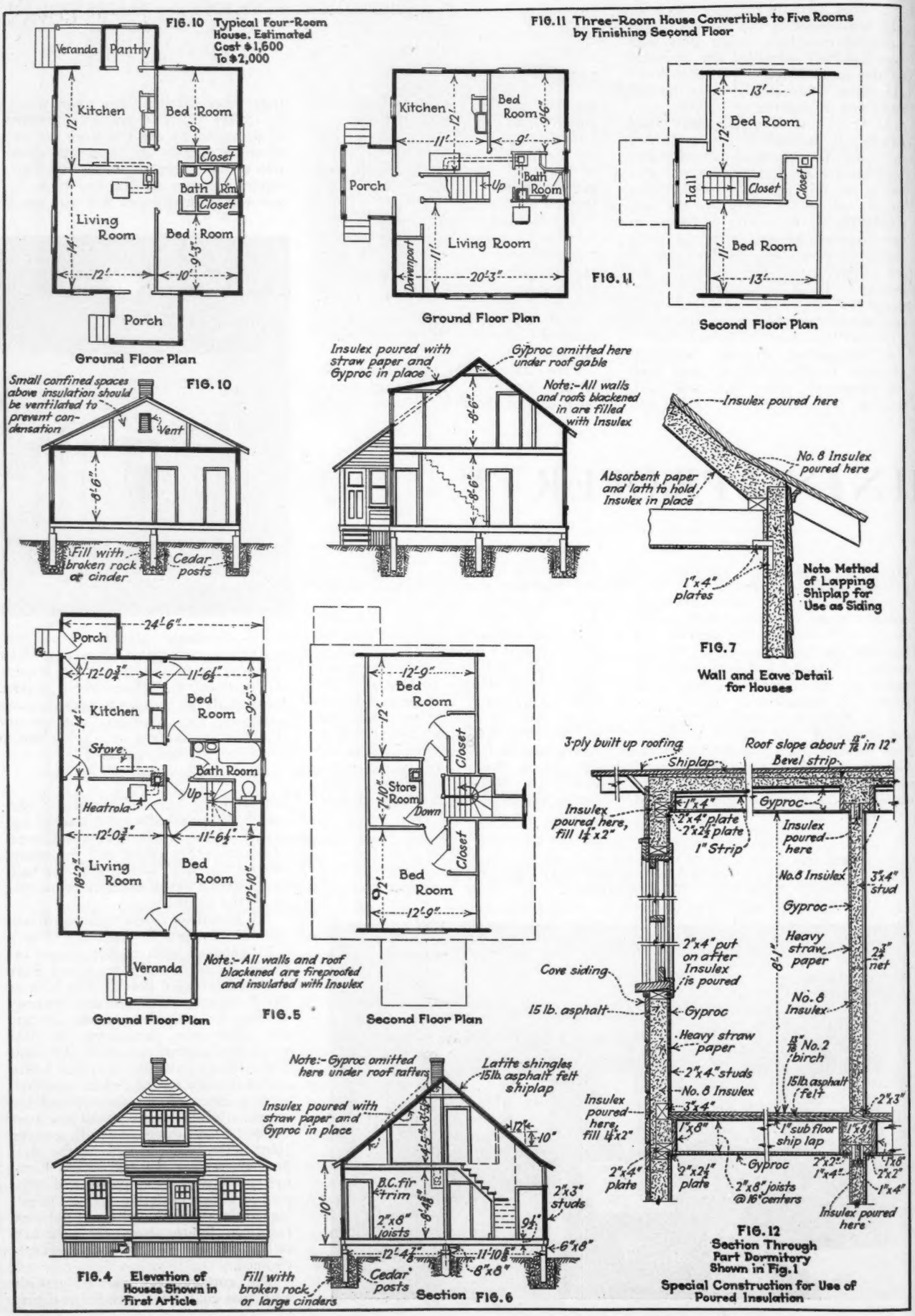


FIG. 10 Typical Four-Room House. Estimated Cost $1,600 To $2,000

Ground Floor Plan

FIG. 11 Three-Room House Convertible to Five Rooms by Finishing Second Floor

FIG. 11

Ground Floor Plan

Second Floor Plan

FIG. 10

FIG. 7

Wall and Eave Detail for Houses

FIG. 5

Ground Floor Plan

Second Floor Plan

FIG. 4 Elevation of Houses Shown in First Article

Section FIG. 6

FIG. 12 Section Through Part Dormitory Shown in Fig. 1

Special Construction for Use of Poured Insulation

paint, in shades of gray, no two adjoining cottages having the same combination of color, and the trim differing from the body color. The construction at the eaves, giving a short lower section at a different angle than the main roof, improves the appearance. Cedar shiplap, placed as shown in Fig. 7, was used instead of the more expensive cove or clapboard siding, and by adopting different widths the appearance was varied from house to house. The cottages were set at different distances from the street line to avoid monotony and improve the view lines from the rooms. One cottage is set at right angles, and minor differing features are noticeable in ridges and porches. Such diversification, which vastly improves the general appearance, can be carried through any number of houses in a group.

Each cottage is furnished with a white-enamel kitchen sink and a complete white-enamel bathroom set with nickel-plated fittings. A hot-water tank, in one corner of the bathroom, contributing some heat to this room, is connected to the kitchen range and sink and to the bathroom fixtures. The sewer pipe is carried directly down to below frost level and is connected to a septic tank serving all cottages. Electric-light fixtures are provided in all rooms, with a sufficient number of base outlets. The rubber-covered wires in the insulated walls, using open-knob and tube-type of installation, were buried in place at the time of pouring the insulation, as is approved by the Provincial Power Commission, reducing the danger of electrical fires. Gypsum insulation is an excellent nonconductor of electricity.

The cost of a cottage complete as outlined and including all the fixtures enumerated, consulting services including the general placing and designing of these and several other types of residences, detail designing, and construction superintendence, was a litfle over $3,000. With more favorable weather conditions, and by building a larger number of houses at a time, the cost could be reduced to less than $3,000. The settlement is four miles from a branch line of a provincially owned railroad, and 475 miles north of Toronto, the nearest wholesale center. Labor rates for a nine-hour day were 72c. per hour for carpenters, 53c. for laborers, and 72c. for electricians. The men were well selected and efficient, but were handicapped by weather conditions. Lumber and timber cost at the site ranged from $36 to $44 per 1,000 ft. for the various sizes and grades.

Results obtained from this type of construction have been most satisfactory. The cottages are neat and pleasing in appearance, fire-safe, and comfortable at any season of the year. One stove or heater in the living room, with some heat during a portion of the day from the kitchen range, or from a small hot-water heater where an electric range is used for cooking, heats the entire house without forcing the fire in the coldest weather. Even the northwest room, at the greatest distance from the source of heat, is sufficiently warm to be used as a dining room. The fuel consumption in winter has been one-third to one-half that for similar-sized houses in the near-by towns, and in one instance only 5½ cords of wood was burned during five months of midwinter. Fires were not usually kept burning through the night even in severe weather, as the slow heat leakage held the interior temperature high enough to prevent water pipes from freezing, although the outside temperature reached 42 deg. below zero. This is because the walls have a heat resistance of about 11.5 hours and the roof of over 14 hours, in contrast to about 5 hours for the ordinary frame construction with double outside sheathing, even granted that such construction were more than ordinarily air-tight.

A dormitory or bunkhouse to accommodate 50 men was also built at this time, designed with a lower floor to be used as a staff house, and an upper floor for use of skilled and semi-skilled labor, the finish and furnishings being more expensive than they would be in a building used for general living quarters. It is 103 ft. 6 in. long and 27 ft. 3 in. wide, with an inclosed porch section 8 ft. 4 in. by 18 ft. 2 in. There are eighteen single rooms and a bathroom on the first floor, each room being 8 ft. by 10 ft. 8 in. The upper floor has fourteen rooms arranged to accommodate two men each, with the smallest rooms 10 ft. by 10 ft. 8 in. This floor has its own bathroom, equipped, like that on the first floor, with six porcelain sanitary-type wash basins, three shower baths, two sanitary toilets, and two urinals. Both floors have a common or living room at the south end of the building, 18x27 ft., with inclosed porch on the first floor and a separate room above this on the upper floor to provide additional recreation space for the larger number of men on that floor. The ceiling height of the sleeping rooms and corridors is 8 ft. 1 in., and that of the common rooms is 9 ft. 1 in. All floors are of oiled birch or maple; the trim is clear fir and pine, with clear fir-paneled doors, and all doors leading to stairways or bathrooms and at the ends of the corridors are self-closing, the outside rear doors having panic locks operated by push rods from the inside. The rooms are furnished with steel beds finished in mahogany enamel, with linen, chiffonier, writing table, chair, rug, and a shelf and hooks for clothing. The common rooms have two long hardwood reading tables in each room, with three square card tables and a sufficient number of large, arm-type chairs, and in the room used by the staff the men have supplied potted plants and a radio set.

Some of the special features of this dormitory which can be adopted in lower-cost structures include:

1. Design of the building with a flat roof, with a large saving of cost and the better utilization of the space inclosed. Four inches of insulation in the roof gives complete protection from cold in winter and heat in summer, and with the wide protecting cornices the structure has a pleasing appearance.

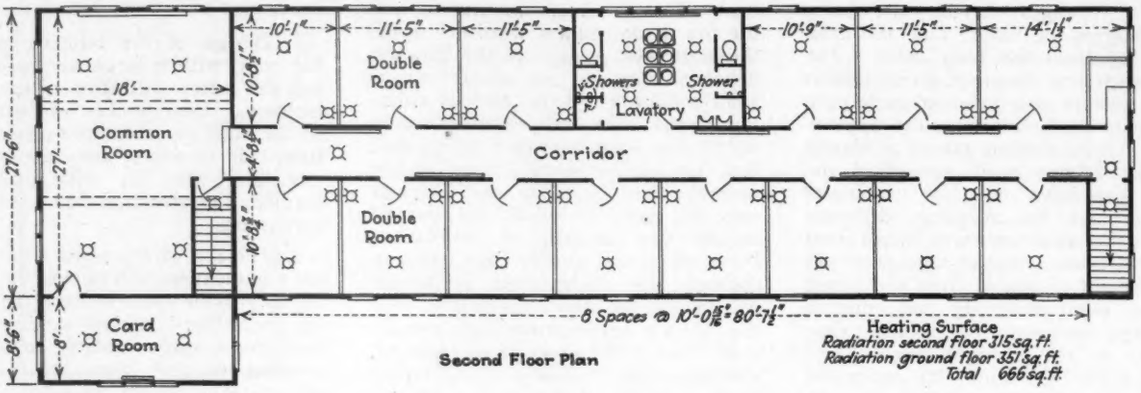
2. The use of creosoted cedar posts for a foundation, and raising the building to provide space beneath the sleeping rooms for large hot-water storage tanks for a surge capacity at times of greatest demand from the showers, and to give access to piping. The outside wall is carried down to the ground with one layer of 1-in. boards and one layer of V-joint matched lumber, with asphalt paper between the layers to make an air-tight windbreak.

3. The use of 2x3 in. studding, laid flat or with the 2-in. side for wall thickness in the interior uninsulated partitions, and with the 3-in. dimension as wall thickness for insulated partitions, giving about 2¾-in. net of insulation for corridor and other separations, which is sufficient for insulation and fire protection. These partitions adequately support the floor and roof loads. They are stiffened by the wall board on each side and braced by the wall board on the cross partitions.

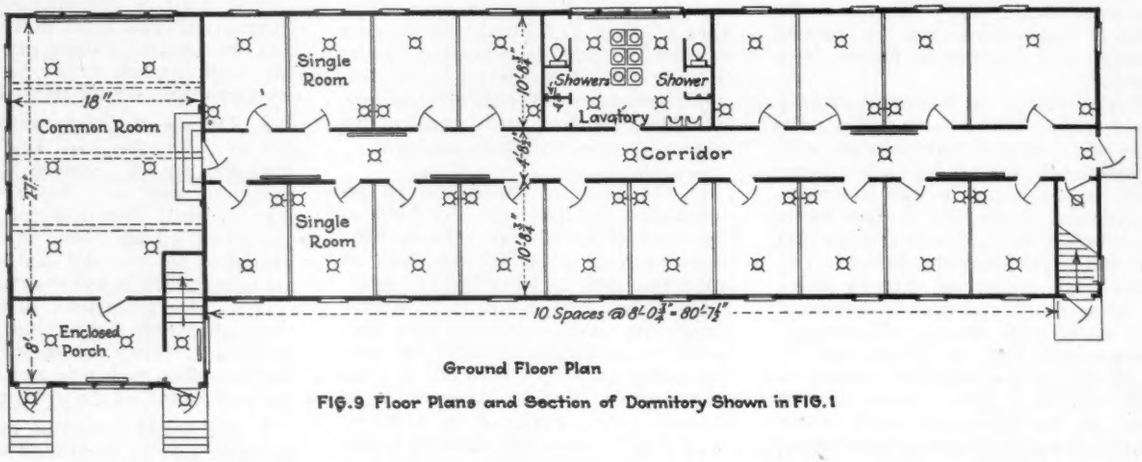
4. The use of insulation in the roof, in walls, and in partitions where fire protection or sound deadening is desired. The outside walls and the roof have about 11 hours' added heat resistance, giving a total resistance of about 14.5 hours. It will be interesting to note that this is at least equal to the resistance of the insulated huts that Commander Byrd is taking on his south polar expedition, as described in press dispatches. As indicated in the drawings, the insulation was poured in all corridor walls; in partitions on each side of bathrooms, and between common rooms and sleeping rooms; and completely inclosing all stairways and fire exits. It would be further desirable, but with some added expense, to insulate the floors. However, with the small amount of combustibles in each room we decided that the gypsum-board ceilings and the hardwood floors would sufficiently confine any inside fire, inasmuch as no openings exist through the floors, the side partitions between the rooms being put up after the entire floor had been laid. A valuable property of these poured gypsum fillings for such a building is that they make the walls vermin-proof.

5. The provision for a greater ceiling height in the large common rooms than in the smaller sleeping rooms, giving better proportion to the rooms and better lighting conditions.

6. Incidental but desirable feature of sound-deadening partitions between the sleeping rooms and corridors, bathrooms, common rooms, and entrances.

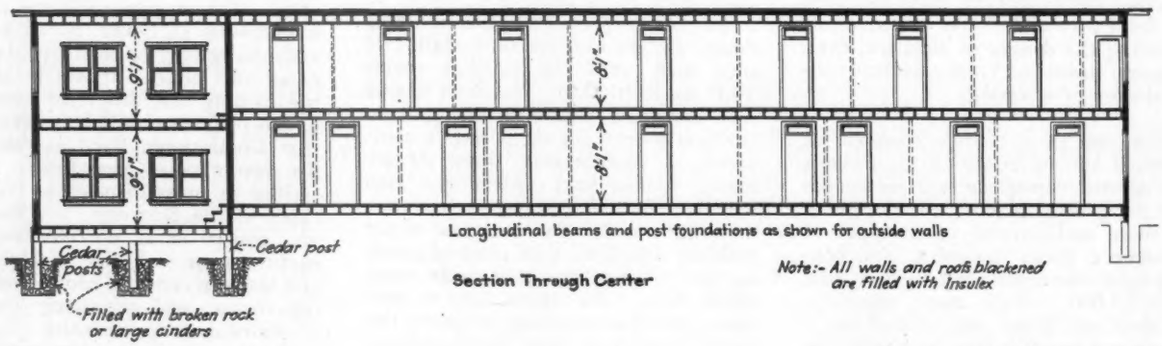


Second Floor Plan



Ground Floor Plan

FIG. 9 Floor Plans and Section of Dormitory Shown in FIG. 1


Longitudinal beams and post foundations as shown for outside walls
Cedar post
Cedar posts
Filled with broken rock or large cinders

Section Through Center

Note:- All walls and roofs blackened are filled with Insulex

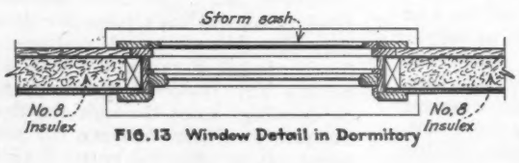


FIG. 13 Window Detail in Dormitory

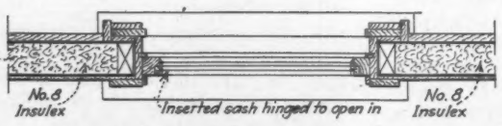
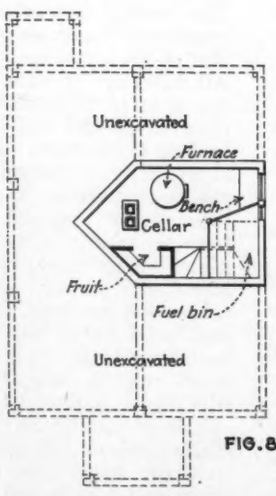


FIG. 14 Double Glass Window Used in Hospital Inserted Sash Opens With Main Sash for Ventilation, But Separately for Cleaning



Basement Plan

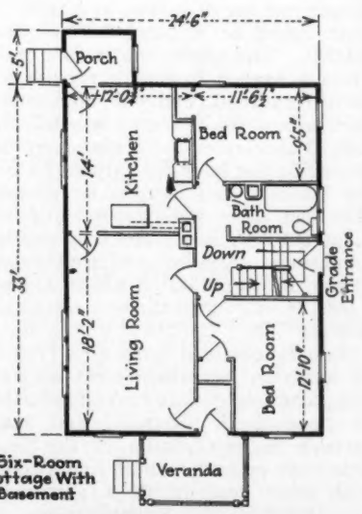


FIG. 8 Six-Room Cottage With Basement

Ground Floor Plan

This, with the exclusion of heat in summer gained by insulating the walls and roof, enables the night-shift men who sleep in the daytime to obtain better rest and thus tends to increase their efficiency and contentment.

7. The entire separation of floors with separate protected entrances, making each floor a unit with no inside communication. This gives added fire protection and provides for segregation of grades or nationalities if this should be desired. Insulation and incidental sound-deadening of the floors would add to this protection.

8. A large glass area in the south side of the common rooms, providing ample light and outlook.

9. All heat for the sleeping rooms is released in the long corridors, which are isolated from the common rooms by heavy double-swung self-closing doors, this arrangement conserving the heat, decreasing the cost of the heating plant, concentrating the piping, and preventing the radiators from freezing, as they often do when placed on outside walls under windows.

Special construction, some of which is shown in the drawings, was used at wall plates, at the tops of partitions, at the roof, and around windows and doors. Gypsum insulation in the walls of the first story was poured from the upper floor after the second-story studding was in position with its covering of asphalt paper and cove siding, which protected the workmen to some extent from the weather. All gypsum board was nailed on the walls of the first story and on such partitions as were to be insulated, and the insulation was poured from the second floor, sufficient being mixed at a time to fill the space between two adjoining studs to a height of about 3 ft. The workmen then moved to the next space, repeating this operation completely around the building. By the time the circuit had been made, the first insulation poured had set, the second filling of 3 ft. being made in a similar manner. After the first-story walls and partitions were filled, the second-story walls and partitions were filled through the roof, where spaces had been left open for this purpose. As the rafters were 8 in. deep, and only 4 in. of insulation was desired, 1-in. wood strips were nailed on the sides of the rafters with their tops 4⅜ in. below the tops of the taper pieces placed on the rafters to give the slight roof slope. Strip gypsum board, cut to the right width, which was mill scrap, and inexpensive, was then dropped on the wood strips and the insulation was poured on this and screeded to the tops of the taper pieces. A layer of shiplap was nailed over, and the roof covering was built up on this, being a Type-A asphalt roof using 15-lb. asphalt felt and an asphalt cap sheet.

Care was taken in designing the building to locate studs, windows, and doors so that standard lengths and widths of the gypsum board would fit in without cutting, and a large saving of labor was thus effected. All walls and longitudinal partitions were completely covered. All floors were laid through, before the sleeping-room partitions were put up, the intention being to give as much straight work as possible and avoid cutting and fitting. The studding was nailed in sections on the floors and raised to place.

Under better weather conditions, this building would be constructed complete, excepting furniture, for about $12,000. To adapt it for use as a staff house, the appearance and finishing are well up to the standards of hotels in smaller communities. A building having the desirable features of this one, but with less costly finishing, and built with two-man rooms on each floor, can be constructed for less than $10,000. If common or recreation rooms are provided elsewhere, the common rooms and entrance porch can be made much smaller, and one bathroom might be made to serve both floors, bringing the cost to less than $8,000. These costs are somewhat less than for the usual type of uninsulated living quarters where a lath-and-plaster or wall-board finish is used throughout, where bathrooms are furnished, and the building is completely finished and painted.

This dormitory has been completely satisfactory, warm in winter and cool in summer. The radiators originally installed had a capacity much less than would be required for an ordinary frame building, but even this was found to be excessive, and units were removed until there remains a total of only 666 sq.ft.; yet the building is, if anything, overheated. To obtain a measure of the saving in heating plant and fuel, the required radiation for an exactly similar frame building was calculated in the usual manner. This had a gable roof with shingles, paper, and sheathing, and walls constructed with cove siding, paper, two layers of board sheathing on each side of 2x6-in. studding, and had gypsum wall-board on all ceilings and walls, with storm sash for all windows. The steam pressure was taken as that actually used during the winter of 1927-28, which is somewhat higher than usual owing to local conditions at the central heating plant. Outside temperature was figured at a minimum of 45 deg. below zero, the temperature under the lower floor 45 deg. above zero, and the highly heated interior corridors 85 deg. Three air changes per hour were allowed for night ventilation, because of the large number of men accommodated, instead of the usual single change. For this imaginary building 1,067 sq.ft. of radiation would be required, compared with 666 sq.ft. now in use in the insulated structure, or a saving of 401 sq.ft.; in other words, it would require an amount of radiation, and therefore of heat, 60 per cent greater than is now used, giving the present structure a saving of 37½ per cent of the plant and heat necessary for an uninsulated building.

It seems evident that the rules for figuring radiation must be radically revised when applied to such well-insulated construction, because the retention of heat for long periods of time tends to smooth the temperature curve throughout the whole 24 hours of the day; it then becomes incorrect to use the extremes of night temperatures as a basis for heating requirements, for to do so leads to needless extravagance in plant capacity and fuel consumption.

Taking all these facts into consideration, the authors conclude that there is little justification for the erection of expensive, fireproof, uninsulated buildings to serve community needs in any ordinary industrial enterprise, where fitness for use is an essential consideration.

Much more attention will be paid in the future to the insulation and fire-safing of wooden construction, which will be widely adopted as being more suitable for the climatic and other conditions found in isolated camps and smaller industrial groups, particularly where construction budgets are limited or where the enterprise has an indeterminate or a short life, owing to the exploitation of wasting assets. Many signs are evident of an aroused interest among engineers and managers who are responsible for the housing of their staffs and employees, and it is hoped that the suggestions and detailed descriptions given in these papers may be helpful.

National Programs for Conservation of Minerals

IN THE next issue is a paper by Dean Frank H. Probert of the College of Mining, University of California, on a subject worthy of thought by mining men all over the world—conservation of mineral resources. "The wisest and most intelligent use of mineral resources seems to call unquestionably for their consideration in their world relations rather than in the narrow interpretation of local requirements," says Dean Probert. "There should be an international understanding in the use and exploitation of mineral resources, which will result in minimum hindrance to the free flow along natural channels of trade." This suggests a broad field of work for the economic council of the League of Nations, and of the International Chamber of Commerce.

Platinum Metallurgy at Onverwacht

A HIGHLY IMPORTANT PAPER on platinum metallurgy at Onverwacht, in the Transvaal, was delivered before a meeting of the Chemical, Metallurgical, and Mining Society of South Africa on Jan. 19 by Messrs. T. K. Prentice and R. Murdoch.

The Onverwacht dunite pipe was not the first platinum discovery in the Lydenburg district, A. F. Lombard having reported the metal on Maandagshoek in August, 1924, but it is conceded that W. F. Blaine's discovery on Onverwacht, in October of the same year, was quite independent. The authors give an account of the situation and geology of this famous pipe, and the following typical analysis of the metallics as recovered:

	Per Cent	
	Surface	200 Ft. Depth
Pt	84.0	84.75
Os, Ir	2.3	0.95
Rh	0.2	Trace
Pd	0.3	1.28
Cu	Trace	0.48
Ni	....	0.53
Fe	12.8	11.98
	99.6	99.97

Experiment showed that the crushed ore could be concentrated readily. The ratio of concentration was raised by stages until, at the Ferriera Deep experimental plant, where fourteen tons was treated, it was demonstrated that a concentrate amounting to 1.7 per cent of the original ore, and carrying 83 per cent of the metallics, could be recovered with certainty. By this time, the treatment of the concentrates was only in the laboratory stage, but, as promising results had been secured and platinum was £25 per oz., it was decided to proceed with a pilot concentration plant capable of handling about 1,000 tons per month. By the time this was ready, in January, 1926, the final treatment process had also been worked out satisfactorily.

The concentrates above mentioned averaged 600 dwt. per ton, or about 0.1 per cent, so the desirability of enrichment to at least 50 per cent, for subsequent handling by the refiners, was obvious. Cyaniding, chlorination, and straight amalgamation were tried, but proved of no avail. However, an amalgamation process in which the amalgamation of the platinum is promoted by activating reagents in the form of zinc amalgam, copper sulphate, and sulphuric acid gave such encouraging results that it was investigated thoroughly. This process, being in essence that described by V. J. Zachert in the *Mining & Scientific Press* of Oct. 12, 1918, was not patented. The reactions were obscure, and many experiments were carried out to elucidate them. As a result of these experiments it appears that the formation of hydrogen, whether generated by an electric couple or by the action of the acid on zinc, is essential. The nascent hydrogen, with the zinc amalgam, forms hydrogen zinc amalgam which, like hydrogen sodium amalgam, has a remarkably powerful amalgamating action and an affinity for platinum. Nascent hydrogen itself is commonly made use of in gold metallurgy to reduce many substances which interfere with amalgamation. Tests were made in which the nascent hydrogen was produced solely by an electrolytic couple and not by the action of sulphuric acid on zinc. Zinc and platinum constituted the couple, and the electrolytes tried in different tests were caustic soda, sodium chloride, and ferrous sulphate. The residues from these tests assayed respectively 17.5, 21.3, and 22.3 dwt. per ton, whereas, when, in addition to the zinc-platinum couple, sulphuric acid was used, the residue from the same concentrate was 3.0 dwt. Copper sulphate is not essential to the reaction, but, by the precipitation of copper from the sulphate by zinc during the amalgamation, improved results were obtained. Platinum by itself will not precipitate copper from copper sulphate when acidulated with sulphuric acid.

An Appreciation of Efficient Work in a Lonely Camp

By Charles Butters

MINING in Central America is carried on under such difficulties that it is a pleasure to watch the consistent operations of a mining organization like the New York & Honduras Rosario Mining Company. Success has been achieved in spite of the acute topography of San Juancito; the difficulties of transport; the revolutions that disturb the country; the labor that must be handled; and the loneliness of the isolated camp which produces among the white employees an irritable disposition, brings about sickness, and is conducive to ennui. There is thus a greater turnover than in camps where there is a chance to go to the city occasionally or to visit a near-by camp, or to get some other change to avoid monotony.

A. R. Gordon, a big, quiet, serene, competent manager, holds the balance safely and surely at San Juancito, and Mrs. Gordon makes life as pleasant as possible in this remote place, where one emerges from the clouds and rain after crossing the divide from Tegucigalpa and lands in a hotel with every electrical convenience. Everywhere one goes, from the doctor's domain to the blacksmith shop, the last thing in science and skill is evident—electric welding, a foundry for making special alloys, a printing office, a refined home for the manager, and the same for the mine officials. In other words, civilization is brought to San Juancito by the co-operation of a highly intelligent board of directors thoroughly in sympathy with the management. The members of the staff feel that they are having the benefit of the best that money can buy, and that stimulates the engineer and the metallurgist each to do his best.

Studying the record for the last two years it is evident that it takes one foot of development to produce five tons of ore. This aggregates nearly five miles of development every year. Narrow veins, some only 12 in. in width, are explored. Twenty inches in width is considered to be a good vein. It takes some planning and a lot of development to get the 110,000 tons for the year, but the management seems to find the tonnage, and of a good grade. Following are the figures for 1928 and 1927:

	1928	1927
Dry tons crushed	110,600	108,400
Silver produced, oz.	2,287,030	2,172,753
Gold produced, oz.	8,501	5,683

Development in 1928 consisted of 21,947 ft., distributed in headings, crosscuts, raises, and shafts. Development in 1927 was 18,892 ft., about 3,000 ft. less, similarly distributed.

The San Juancito mining enterprise is a fine example of what is known as human engineering, nowhere more necessary than in an outlying foreign mining camp. It gives a splendid training for the highest type of executive position such as one of our brother engineers has just been called to fill. President Herbert Hoover, mining engineer, was thoroughly drilled in just such camps.

Long-Distance Transportation of Molten Metal

Fig. 2—End view of a hot-metal bridge, as described

To the Editor of "E.&M.J.":

The picturization of the 10-mile transportation of molten iron from Hamilton to Middletown, Ohio, in the issue of Feb. 2, 1929, should induce others to show how they move metal (any metal); also slag. At and near Pittsburgh an enormous quantity of molten and granulated slag, and molten iron and steel, is moved daily. Most of the molten metal is moved within the confines of the works, but from three of the blast-furnace plants, molten iron is hauled across the Monongahela River, spanned by three "hot-metal bridges" to open-hearth and converter plants for conversion to steel. The distances are several thousand feet each. From two of the blast-furnace plants molten slag is hauled across two of the bridges and thence to dumps several miles distant. Briefly, the operations are as follows:

On the north side of the river the Jones & Laughlin Steel Corporation has six blast furnaces, the Eliza group. They produce molten iron for the open-hearth furnaces and converters on the south side of the river. This is hauled across a through-truss, plate-floor, and open-tie type of bridge 1,161 ft. in length. When five blast furnaces are in operation, 24 trains a day cross the bridge. Each train is made up of a steam locomotive and two ladles each weighing 87 tons and carrying 90 tons of metal, and a caboose, as shown by Fig. 1. The molten iron so carried totals 4,300 tons a day.

Fig. 2 is an end view of one of the Union Railroad Company's hot-metal bridges across the Monongahela River, near Braddock. This railroad is a subsidiary of the U. S. Steel Corporation and this bridge and one downstream at Rankin serve plants of the Carnegie Steel Company. This picture shows plainly the plate-floor and concrete and open-tie construction. The track on the right is for trains hauling molten iron and slag, and the special construction is for protection of river steamers and tows against possible spillage of the molten materials from the trains above. Excluding long Y-approaches, the two bridges are 1,316 ft. and 744 ft. in length. At the Edgar Thomson works, at Braddock, are eleven blast furnaces, the iron from some of which is hauled in 35-ton conical ladles across the bridge shown to open-hearth furnaces at Homestead. At Rankin, iron from seven blast furnaces, the Carrie group, is sent across another bridge to Homestead in trains made up of four 35-ton ladles. Thirty trains a day carry about 4,200 tons of molten iron. As to molten slag, twelve trains of eleven seventeen-ton ladles and eight trains of twelve seventeen-ton ladles, as in Fig. 3, or a total of 3,800 tons, is moved across the respective bridges and to dumps, where it is poured. Granulated slag is hauled out in cars of 50- to 70-ton capacity. The movement at this point of 8,000 tons a day of molten metal and slag, also trains of granulated slag, trains of iron ore, trains of coal and coke, trains of scrap, and trains of finished products from the local

Fig. 1—Train of two ladles of 90-ton capacity each of molten metal

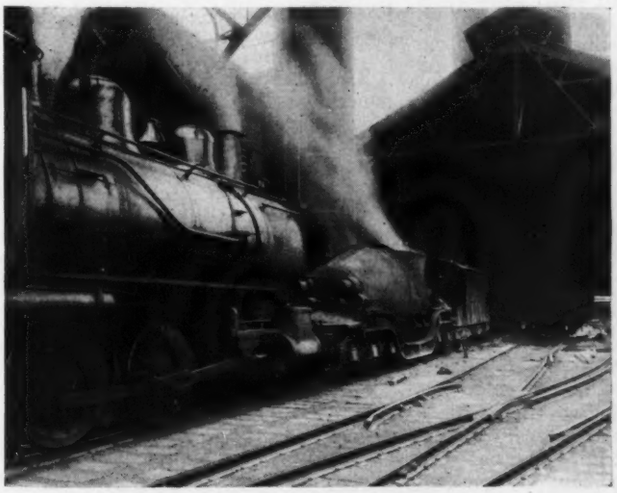


Fig. 3—Train of twelve ladles of seventeen-ton capacity each of molten slag

plants, and trains from other points, make one of the busiest spots imaginable. M. W. VON BERNEWITZ.

Pittsburgh, Pa.

Comparing Success in the Games of Bridge and Mining

In discussing a paper recently read before the Institution of Mining and Metallurgy by Mr. T. G. Trevor, on "Prospecting and the Discovery of Mines in South Africa," Mr. R. Murray-Hughes said, *inter alia*, that:

In no other country in the world has scientific prospecting been granted so generous a purse as in Northern Rhodesia. Every conceivable device, ranging from electrical surveys to aërial mapping, has been employed. Have these devices yielded anything tangible and has the expense been justified?

In spite of having to answer negatively such questions as—Did they help to find Roan Antelope? Did they help to find Broken Hill? I venture to say that they have justified themselves, but it will take time to appreciate the full benefit derived from them.

It is said that success in the game of bridge may be divided as follows: 30 per cent in the call, 15 per cent in the play, and 55 per cent in the cards; but because 55 per cent of the game depends on chance, no serious player fails to develop the scientific side represented by the "call" and the "play."

So, in a similar way, the art of prospecting has developed, and we find that we stand a better chance of finding something if scientific principles are followed. No experienced mining geologist has thought for a moment that geophysical methods of prospecting are a panacea for non-existent orebodies, but they can and do provide an additional and extremely useful tool in his kit, along with his pick and compass. These devices, therefore, may be regarded as steps toward increasing our geological knowledge only, and so we arrive at another point, that of the use of the geologist in prospecting. May I give a personal illustration. While I was acting as geologist to the Rhodesian Minerals Concessions, Ltd., the company was granted a new concession covering some 7,000 square miles. I made a reconnaissance of the area and found in it a body of late granite, intrusive into the older sedimentaries. Unfortunately, the greater part of the contact-metamorphic zone was completely hidden by the mud flats of the Kafue River, but in one small corner of the concession, on slightly higher ground, it was found that the altered zone made its appearance.

Prospecting parties were drawn from all four corners of the concession and concentrated in this area, and, within a few months, the Luiri mine was found, which, as some of you may know, promises to be quite an important gold producer. Is it too bold to say that 30 per cent of the success depended on a definition of the geology, 15 per cent on the local search, and 55 per cent on what Nature provided?

Modern economic geology has abandoned any classification dependent on form, and is fully alive to the fact that a group of minerals usually found as vein components may one day be found forming important topographical units. An example of this may be found in the quartz-gilbertite rocks of Northern Rhodesia. This partnership is usually found in veins and small bodies, forming the hydatogenic phase of expiring igneous activity. In Northern Rhodesia, it forms massive hills 300 ft. or 400 ft. long and 100 ft. high. In the old days this might have been classified as a "new departure"; nowadays, it is an occurrence of great interest but not one to upset preconceived ideas.

Avoiding Cyanidation Losses by Treatment of Colloids in Pulp

To the Editor of "E.&M.J.":

The letters on the absorption and adsorption effects of colloid slime, appearing in your issue of Dec. 15, are of great interest to hydrometallurgists.

Your correspondents, Messrs. Gross and Zimmerley, discuss the cyanidation losses of gold due to excessive grinding and mention that after 400 mesh "there still remains a product varying in size from 37 microns to possibly the unit crystal size, in which range extremely large surface areas obtain." I do not think gold solution would be adsorbed in such a case, for in crystalline material, however fine, it may be washed out if the washing is carried far enough. In a true colloid, however, adsorbed gold solution cannot be washed out, and, to recover it, the colloid must be destroyed.

At Santa Rosa, Mexico, in 1912, we experienced much the same condition as is described in the extract you give from the *Transactions* of the Institution of Mining and Metallurgy, and an account may be of benefit to other readers of your interesting journal.

Shortly after starting the plant our washed gold residue rose from 0.02 oz. to an average of 0.16 oz. The treatment consisted of grinding to approximately 75 per cent through 200 mesh, agitation of the slime, and filtering on a Butters filter. Hand-washing a sample of the filtered tailing until not a trace of the gold, cyanide, or lime could be distinguished in the wash water failed to reduce the gold in the tailing below the figure mentioned, but after much research we found that by drying the slime, breaking up the lumps, and again washing with water, three-quarters of the contained gold was washed out; and by washing with a weak cyanide solution practically a total extraction was obtained. The ore contained a large proportion of hydrated silicate of aluminum and possessed a high latent acidity, causing a lime consumption of 22 lb. per ton. The lime, acting as an electrolyte, coagulated the slime, turning the sol particles into a gel. Furthermore, not only was the dissolved gold adsorbed by this gel, but fine particles of undissolved gold were mechanically inclosed, making them immune to the attack of the cyanide solution.

Adsorption may be described as a property by which dyes and other substances are extracted from solutions and incorporated into the thing dyed, and in our case we diagnosed that the gold in solution was the dye and the coagulated slime, the thing dyed. This apparently was attributable to the impossibility of washing the dissolved gold out of the slime; in drying the slime we simply destroyed its colloidal property. We further proved our discovery on a large scale by loading the Butters agitating tank with 30 tons of slime tailing which had lain for several months in the sun and become quite dry; after agitating for half an hour with 0.025 potassium cyanide solution we obtained a result which brought smiles to faces which for some time had been regarding the future with the gloomiest apprehensions.

Having discovered the cause of our trouble, we first decided to continue treating the ore as usual, discharge the slime into different "paddocks" to dry in the sun for a couple of months and then re-treat it, which practically amounted only to picking it up and washing it in a weak cyanide solution for the recovery of the remainder of the gold. However, to avoid this secondary treatment and the building of the necessary plant, we thought the desired result might be obtained in the mill circuit by the application of osmosis or by breaking up the colloid in some way, but the adverse political conditions of the country caused us to suspend operations before any results of experiments in this direction could be obtained. It has been a matter of regret to myself that I had not another opportunity of following up the work, for I believe that the extraction in many cyanide plants could be improved if the possibility of more or less colloid adsorption and absorption was recognized.

The late H. E. Ashley wrote several papers on this subject and described how the plasticity of clays can be measured by their adsorptive powers—see Bulletin 388 of the U. S. Geological Survey, 1909, and Technological Paper No. 23 of the Bureau of Standards, 1913. I discovered the former paper several years after the above experience and would recommend it to anybody interested in the subject. Had we possessed it in 1912 there would have been no trouble. F. H. JACKSON.

Sydney, N. S. W.,
Feb. 5, 1929.

[Mr. Jackson's further contribution to this discussion is welcome. If other readers have experienced similar condi-

tions to those described, and have been successful in destroying the colloidal properties of deleterious substances in the pulp, through treatment in the mill circuit or otherwise, a brief description of their work will prove interesting reading.—The EDITOR.]

Tri-State District Faces Difficult Conditions

To the Editor of "E.&M.J.":

We have read with interest your editorial in the Feb. 16 issue of *Engineering and Mining Journal,* entitled "Tri-State Reduces Costs in Spite of Decreased Output." We feel, however, that your readers are probably entitled to further analysis of the reduction in Tri-State costs shown by the Tri-State Zinc and Lead Ore Producers Association's figures and quoted in the editorial.

There are probably four main causes for the decrease in the operating costs per ton of concentrates from 1926 to 1928, as follows:

1. A decrease in the amount of prospecting and development work. Our itemized figures show a decrease of about one-third in the cost for this item, and a survey of the number of churn-drill rigs operating in the district, made by Mr. Carl Carmean, of the Federal Mining & Smelting Company, shows a decrease from 413 rigs operating in September, 1926, to 121 two years later.

2. The selection for operation mainly of properties which are in the most favorable condition for cheap and profitable mining. The 32½ per cent decrease in production to which you refer has been brought about in large part by shutting down the less efficient and lower-grade mines, though also by the adoption for periods of time of the five-day week, together with general adherence to the policy of single-shift operation. As a general rule, only those mines have been operated which could make ends meet on a one-shift basis.

3. A drop in the wage scale, averaging about 9 per cent. Since the labor item makes up fully 50 per cent of the operating cost, this factor accounts for about a 4½ per cent reduction in cost, or more than one-third of the 12½ per cent reduction to which you refer. The wage scale in the Tri-State district is governed by the price of zinc concentrates, and has for many years gone up or down with each $5 increase or decrease in the price. Out of consideration for the workmen, however, no cut was made in 1928, when the price for a considerable period of time dropped below $40.

4. An increased concentrate yield, due to selective mining and somewhat improved milling.

The above analysis indicates that some of the means by which a reduction in costs has been brought about have meant a hardship to both workmen and mine operators. Price conditions in the zinc industry have not been of a stimulating nature for some time, and it seems unfortunate that the Tri-State district, from which the country obtains the equivalent of fully 45 per cent of its metallic zinc, should have to face these difficult conditions.

JULIAN D. CONOVER,
Secretary, Tri-State Zinc and Lead Ore Producers Association.
Picher, Okla.

By The Way

It Happened in Keewatin Formation

OUR magazines of fiction are fearfully and wonderfully made; and when one of their story writers strays from the realms of imagination into scientific bypaths the result is generally sardonically interesting to the informed. Thus the *Red Book Magazine,* introducing a heroine:

"Then he had seen her standing tiptoe at a ticket-window in Winnipeg. At the Pas—that gateway into New Manitoba and dimly known Keewatin—he had come suddenly upon her in the Hudson's Bay store, and that night his room in the Star-Board had been next to hers.

"Now, on this freight-passenger train crawling on northeast toward the End of Steel, she was still his fellow-traveler.

"Stanley wondered where their trails, chance-joined for so long, were to separate.

"A cool piney breeze through the window was rippling her silken hair like unseen fingers. When she stood, to take down a package from the rack above her, Stanley had the impression of a body as willowy and graceful as a dancing girl's. In her whole bearing she seemed so unawakened, so very unaware of her beauty.

"This girl was a presence in the car; the talk was not so rough as it would have been; glances went her way; no one of the men for an instant was unaware of her. Stanley observed that, unlike himself, she was not at all a stranger in this pioneer country of fur-trading and feverish prospecting. A good many people on the train seemed to know her well; and they treated her as though she were a princess. A trader from over Churchill way had awkwardly made her a present of birch candy. She had bought a ticket for the day-coach; but Conductor Waterby, a bluff, fatherly sort of person, indignantly marched her back to the Pullman and ensconced her there with pillows and magazines. A grizzled old prospector, guiding into the bush a party equipped with a "radiore" or radio prospecting-machine, had visited for an hour with her, and unthinkingly eaten half her box of chocolates. An Indian, a fine-looking, intelligent young man, had brought a bouquet of wild-flowers and chatted familiarly with her; and Stanley was amazed to hear an Indian language, which he thought must be Cree, flowing smoothly from her lips."

The highfalutin' nonchalance of the literary person responsible for such a state of affairs cannot obscure two practical matters: Conductor Waterby knew how to handle the Pullman folks and the Southwestern Engineering Corporation Radiore people are presented with a publicity boost beyond their own scientific and modest claims and objectives. Also the fondness of the grizzled old prospector for chocolates indicates the great strides that humanity has made in the land of Our Lady of the Snows, a reflection, no doubt, of the benign leadership of Messrs. Cannon, Pickett, and McBride, though these worthies have not as yet extended their era of bread and water penalty into Canada. We hope that among the wildflowers there was a buttercup—for the grizzled old prospector. Every g.o.p. we ever knew just doted on buttercups. May their effulgence help to light the "dimly known Keewatin."

Consultation

Largest Mines in the United States

"Can you furnish me with the name and address of the mine in the United States which is the largest producer of gold, silver, lead, copper, zinc, nickel, iron, aluminum, manganese, mercury, and tin?"

This brings up, once again, the question of what constitutes a mine. For your purposes we have assumed that you mean contiguous group operation by one company—that is, an operation in which all the producing properties are adjoining, even though they may be worked through several shafts. Working on this basis, the largest producers of the metals you mention are:

1. Gold—Homestake Mining Company, Lead, S. D.

2. Silver—Anaconda Copper Mining, Butte, Mont. However, if production from a single property be taken as the criterion, Park Utah Consolidated, Park City, Utah, would be the largest.

3. Lead — St. Joseph Lead, Bonne Terre, Mo.

4. Copper—Utah Copper, Bingham Canyon, Utah.

5. Zinc—New Jersey Zinc, Franklin, N. J.

6. Nickel—No production of nickel was reported for any United States mine in 1928.

7. Iron—Oliver Iron Mining, Duluth, Minn.

8. Aluminum — American Bauxite, Bauxite, Ark.

9. Manganese—Trout Mining, Philipsburg, Mont.

10. Tin—No tin production of any importance is made in the United States.

11. Quicksilver—Nevada Quicksilver, Lovelock, Nev., is now producing at about the highest rate of any American quicksilver mine. However, this property only started to produce last August, so leadership should perhaps go to New Idria Quicksilver Mines, Inc., Idria, Calif.

If any producer feels that his importance has been underestimated in this compilation, it is hoped that he will write.

INDUSTRIAL PROGRESS

High-pressure Lubrication of Mine Equipment Cuts Cost, Is Safer, and Lessens Fire Risk,

By J. A. Martz
Alemite Manufacturing Company, Chicago

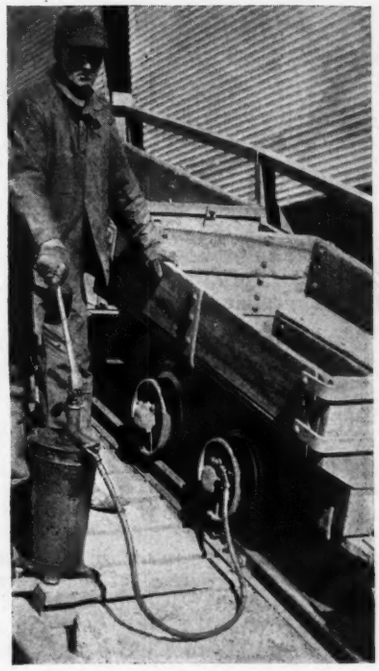
A CHARACTERISTIC of production in all branches of industry today is the effort to eliminate waste. Increased attention is being given to lubrication for this reason. In the past not only have disorganized lubrication methods failed largely to prevent bearing failures, but these old methods have also cost a great deal more than a dependable system of lubrication ought to cost.

In speaking of the lubrication of mining equipment, we must include all machinery—on the surface and underground. One unfortunate aspect of the old intricate and laborious methods of oiling and greasing has been that systematic attention has been given to only a few of the most important machines. Most of the bearings have been customarily neglected. The plant superintendent will often point to one or two bad bearings as his lubrication problem, not realizing how much oil is being used and how many repairs are being made on the several thousand other bearings of the plant. Of course, special bearings do sometimes make difficult lubrication problems. But in the average plant the most money can be saved by eliminating wasted effort and repairs on the hundreds or thousands of bearings that are generally neglected.

Oiling by Hand Daily Expensive

The fundamental difficulty with the oil can is that the oil runs out of a bearing as rapidly as it runs in. To keep a bearing oiled the oil can must be applied daily. This is seldom done, except to a relatively small number of special bearings which are usually equipped with drip cups of some sort. The result is reflected in the repairs made necessary by bearings frequently running dry.

Daily application of lubricant involves high labor cost. In addition, much oil is wasted whenever the oil can is pointed at open oil holes. Most of the oil misses the hole, and the small amount that gets into the housing works itself out toward the ends and is thrown away by the rotating shaft. Of the fluid oil purchased by the average industrial plant approximately 85 per cent is utterly wasted.



Lubricating car wheels at an Oklahoma mine

This mine reduced its car wheel lubrication costs from $8.56 per car per year to 54c. per car per year

Grease cups involve the use of an open grease bucket and paddle. When handled this way grease becomes dirty and affected by moisture. The dirt in grease naturally causes abrasion to the bearing and aids in clogging the channels. Often threads are stripped and the tops of the cups thrown away or lost. Then the bearing is left without any means of lubrication until a new grease cup is installed. Such replacements are often neglected.

In modern plant lubrication the tendency is toward high-pressure application. A dirt-proof fitting is installed in place of the grease cup or oil cup and grease is forced into the bearing from a high-pressure compressor. A good lubricating compressor should provide pressure of 1,000 to 5,000 lb. per square inch, compared with 25- to 60-lb. pressure available from grease cups. This comparison will show why the use of high pressure eliminates trouble from clogged bearings.

Open Oil Holes Should Be Closed

An improvement recently effected in high-pressure lubrication makes it possible to include 95 per cent of all open oil holes in the same high-pressure sys-

One section of a belt conveyor 4⅓ miles long on which more than 50,000 high-pressure lubrication fittings have been installed. In three years of daily operation no bearings have been replaced because of lubrication trouble.

tem that is applied to threaded channels. Briefly, the arrangement is as follows: Bushings with shanks from ⅛ in. by sixty-fourths to ½ in. in diameter are driven with an ordinary hammer into the oil holes. The shanks of these bushings are reverse featheredged to prevent their being shaken out of the hole by vibration. Into the tops of these bushings are installed nipples with ball check valves for receiving the nozzle of the high-pressure compressor. The nipples are of standard size for all bushings and may be had with either straight or angle approaches. With this particular high-pressure system the coupling of the compressor is all metal and is automatic. The compressor is pistol-shaped and its nozzle is merely thrust against the lubrication fitting.

Whenever high-pressure lubrication is adopted, the open oil holes should be closed in this manner. High-pressure lubrication can thus be applied to about 90 per cent of all bearings. The remaining 10 per cent are bearings which are especially constructed for oil bath and the like.

What results can be expected from changing the lubrication system in this manner? In general, the high-pressure system saves at least half of the labor formerly used in oiling and greasing. It saves at least one-third of the lubricant bill, and practically eliminates lubrication failures. Following are examples:

Lubricating the armature bearings of an electric locomotive with a push-type compressor

A belt conveyor, 4⅓ miles long, with 50,000 bearings and running at 500 ft. per minute, is lubricated twice a year with a high-pressure system. Eight men lubricate it in ten days. No bearing repairs due to lack of lubrication have been required in three years.

A large copper company adopted high-pressure lubrication of belt conveyors on test. Some of the statements from the official report are as follows:

"The test was made on a primary crushing conveyor, 512-ft. belt, 60 in. wide, 12 ply, 83 pulley stands. A graphic watt meter was installed on the power line. Formerly the main-drive pulley speed was 31 revolutions in 3 min. and 45 sec. After high-pressure lubrication was adopted this speed automatically increased to slightly over 34. This indicates saving in power.

"The foreman of lubrication states that formerly it took four eight-hour shifts to fill and turn down the grease cups. With the high-pressure system it took an average 4¼ hours to lubricate all bearings with a high-pressure compressor."

A Pennsylvania coal mine practically eliminated expensive replacements of ball bearings of armature shafts in electric locomotives by applying the high-pressure system.

Relative to lubrication of mine car wheels, a leading manufacturer of mine cars writes in detail of results:

"Labor: The most apparent saving is in time spent in lubricating. This time can be cut 50 to 60 per cent by adopting the proper high-pressure equipment.

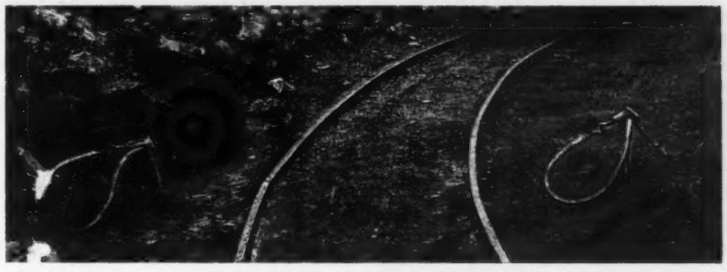
"Cost of lubricant: One pound of grease at 14c. goes as far as 1 to 2 gal. of oil at 30 to 50c.

"Safety: The safety element is increased because no oilers ride the cars and the oilers' hands are always at a safe distance from the bearings being lubricated.

"Fire hazard reduced: Elimination of oil drippage naturally eliminates much opportunity for fire."

A large rock products company recently junked a special type of cup lubricator costing $25 each, and equipped a row of crushers with high-pressure lubrication fittings costing a few cents each. These crushers formerly used 7 gal. of special crusher oil per day at 20c. per gallon. This was reduced to 5 lb. of grease every two days at 15c. per pound.

Another mine had the following experience with mine cars: At this mine 125 cars were equipped with Timken roller bearings. All were equipped for high-pressure lubrication, and the cost of lubrication per car per year is 54c. Formerly, when fluid oil was used, the cost of lubrication per car per year had been $8.56. Savings in lubricant alone amounted to more than $1,000 the first



A system for lubricating mine car wheels

A compressor of 100- to 400-lb. capacity automatically operated by steam or air is installed near the track. A pipe laid under the track carries lubricant under pressure. A man on each side operates a leak-proof nozzle. With this system five men can lubricate 250 cars per day.

Applying grease to a rock crusher with a compressor. Five pounds of grease was made to do the work of 14 gal. of oil

year. In addition, the saving in lubricant amounted to $4,662.40 per year. These figures include only mine car wheels. At this mine, the screens, boom loaders, conveyors, a rotary dump, hoisting engines and fan engines are all equipped and lubricated with a high-pressure system.

High-pressure lubrication is logical because it forces lubricant where it belongs and prevents it from going anywhere else. Its results are positive and it prevents waste. Of course, it does not apply to all bearings. In the average mine or industrial plant, however, all but about 10 per cent of the bearings can be lubricated with a high-pressure system.

A most important feature in industrial lubrication practice today is the use of standardized methods. All machinery possible is placed within one workable lubrication system and exceptions are made only where necessary. In mines where this is being done a great deal of misunderstanding is prevented, labor is saved, and neglect to a large degree forestalled.

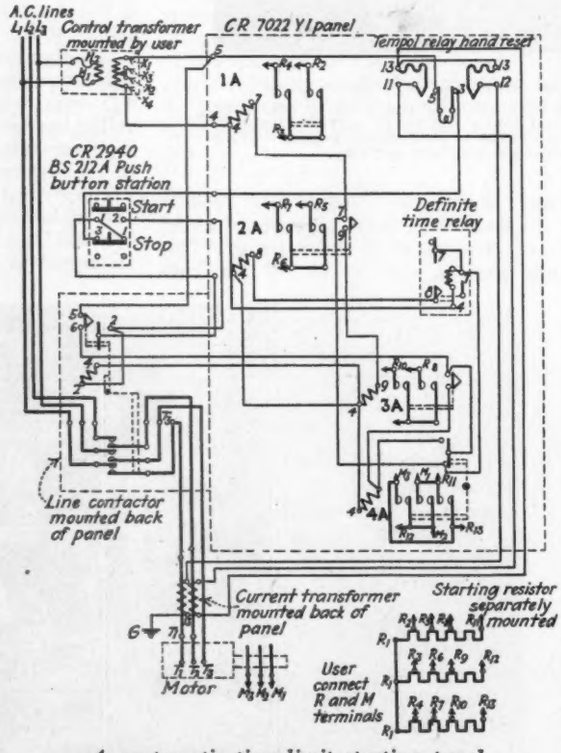
Automatic Time-Limit Starters Preferred for Mine-Fan Motors

By R. S. Sage,
Industrial Engineering Department,
General Electric Company

CENTRIFUGAL FANS, as used for mine ventilation, usually are attended with conditions which affect not only the type of electric motor selected for their drive but the control equipment as well. First, among the instances in which fans for this service usually differ from others, is this: that the fan is large and has an impeller with comparatively large inertia or flywheel effect. Second, practically all mine fans are connected directly to the mine opening without any form of gate in the intake or discharge. Therefore, when full speed has been reached, the fan requires full power for its operation.

During acceleration from rest the motor is required to carry the air load as it builds up with the increasing speed, together with the load of accelerating the fan impeller. The power demand on the motor during starting is therefore very high, and, for a given shaft output, a longer time is required for acceleration than for lighter fans with lower inertia and those with which gates may be used to minimize the air load.

Although all forms of alternating-current motors are used for this application, the wound-rotor induction type most frequently is employed for medium- and large-capacity mine fans. The prevailing tendency is toward the specification of automatic starters for mine-fan motors, and because of its greater simplicity, the time-limit starter is usually preferred. The features referred to in the opening paragraph in general do not render any less suitable the standard wound-rotor induction motor starter using current-limit accelerating relays, although in some cases a third low-setting relay is desirable. For the average installation, however, successful operation will not be secured with the ordinary time-limit starter. For this service a modified time-limit panel is recommended to which a definite time relay is added to prevent acceleration beyond that obtainable on the first point until the elapse of a definite interval of time. For this purpose a relay is utilized to delay the closing of the first accelerating contactor. This relay, energized simultaneously with the line contactor, provides an adjustable time setting of from two to fifteen seconds, which gives the motor time to accelerate the fan slowly to approximately 65 per cent speed before succeeding contactors close and cut out resistance from the rotor circuit. With the standard time-limit starting panel, without this auxiliary relay, the accelerating contactors would close too rapidly, causing, as has actually been the case, heavy enough current drafts from the supply lines to open the circuit breaker. Sometimes, for exceptionally heavy fans, two such time-delay relays may be necessary.



An automatic time-limit starting panel for mine-fan motors

Another factor which requires consideration in this application is the manner in which the motor and fan are connected together. If a link belt is used, as is very often the case, the torque which the motor is permitted to develop on the first point would take up the slack in the chain so suddenly that undue strain would be placed upon it and breakage of the transmission or fan might occur. To overcome this objectionable condition, the automatic starters for chain-driven mine fans are provided with an additional starting point arranged to limit the torque on the first point to approximately 40 per cent of full-load torque, which is sufficient to take up the slack in the chain without undue jerking. A geared-type definite time interlock, assembled on the line contactor adjusted for a short time delay (approximately 1 sec.), controls the closing of the first accelerating contactor. On such panels, the auxiliary time relay previously referred to is wired to control the closing of the second accelerating contactor.

Care should be exercised in applying time-limit automatic starters to wound-rotor induction motors intended for driving mine fans, and, unless the conditions are exceptionally favorable, a special panel, designed as above, should be used. Undoubtedly there are applications involving machines with high flywheel effect other than mine-fan drive for which similar panels could advantageously be used.

The accompanying sketch illustrates the starting scheme described above. This covers a panel for a 100-hp. chain-connected, motor-driven mine fan.

INDUSTRIAL NOTES

H. A. Baker, of Schenectady, has been appointed service manager of the International General Electric Company, with headquarters in New York City. Mr. Baker succeeds C. F. Neave, who has been named manager of the newly organized refrigeration department of the company.

The Trimont Manufacturing Company, of Roxbury, Boston, Mass., has purchased the Stillson wrench business of the Moore Drop Forging Company, of Springfield, Mass., and will continue the manufacture of both the original pattern and popular type Stillson wrenches. The Morco original pattern Stillson will, under Trimont manufacture, be known as the Sando original pattern Stillson and the Morco popular will be known as Moroco popular.

Personal Notes

John Smeddle, of Bonanza Mines, has returned to Nicaragua from Fontana, Calif.

U. C. Tainton, metallurgical engineer, of Kellogg, Idaho, was recently in San Francisco.

F. W. Bradley, president of the A.I.M.E., returned to San Francisco on March 13.

D. R. Reigel, of Spokane, has been elected a director of Dickens Consolidated, operating in the Coeur d'Alene district.

Edmund Jussen, mining engineer, of San Francisco, is now associated with Dr. **George Steiner,** of New York, in making geophysical surveys.

O. R. Turner is in charge of mill operations at the Arabian mine, in Union Pass, near Kingman, Ariz. The Arabian plant has recently started operations.

William Loeb, vice-president, American Smelting & Refining, left New York March 9 on a five weeks' business trip to the Western offices of the company.

George A. Packard, mining engineer of Boston, was recently on a professional trip in Arizona and passed through San Francisco en route to Nevada.

E. N. Hickman, who has been connected with the sales department of American Metal for several years, has been elected assistant treasurer of the company.

Stanley R. Moore, mining engineer, of Wallace, Idaho, left recently for Juneau, Alaska, on professional business. Mr. Moore will remain in Alaska at least a month.

N. W. Rice, vice-president of Western mining operations for the United States Smelting Refining & Mining Company, spent a week in Salt Lake recently on a visit of inspection.

F. Bunyon, metallurgist of the Southern Pacific Company at Sacramento, has been elected chairman of the mining department of the Sacramento Chamber of Commerce.

G. Maejima, engineer for the Pushion colliery, Southern Manchuria Railway Company, was in Salt Lake for a week studying mining methods. Mr. Maejima's headquarters are at Darien.

H. C. Dudley, of Duluth, is in the Southwest looking after his mining interests. Mr. Dudley recently started exploration operations on a group of claims east of Magma Copper at Superior, Ariz.

H. A. Rossell, of Deming, N. M., formerly mill superintendent of Iron Cap Copper, at Globe, will be in charge of operations at the new concentrator of Christmas Copper, near Hayden, which is now under construction.

Why Men Go West

Introducing Mary Higgins, "the Sweetheart of the Babines." Molly is the daughter of Patrick J. Higgins, discoverer of the Victoria group, in the Babine Range-Omineca mining district, about 22 miles north of Smithers, B. C., Canada—where girls are girls.

E. Bachman, engineer in charge of the intermountain mining department of the General Electric Company, left Salt Lake recently for the Flin Flon mine of the Hudson Bay Mining & Smelting Company, where he will spend three weeks.

D. M. Drumheller, mining engineer, of Spokane, is in charge of development of the Mineral Point property, near Osburn, in the Coeur d'Alene district. This property is being opened up by the Coeur d'Alene Mines Company, and is backed by Toronto interests.

C. Q. Schlereth, mining engineer, addressed the Colorado section of the A.I.M.E. on March 1 at its meeting in Denver. He spoke on ancient and modern methods of mining in Greece, and traced the influence of the mining industry on the political history of the country.

S. Power Warren, associate professor of metallurgy at the Colorado School of Mines, at Golden, Colo., has been granted a six months' leave of absence. Mr. Warren sailed from New York on the "Berengaria" on March 8 for Europe, where he will be engaged in consulting work.

Frank L. Hess, chief engineer, rare metals and non-metals division of the U. S. Bureau of Mines, expects to sail on the "President Cleveland" from San Francisco on March 15, on a professional trip which will take him to Shanghai, Canton, and other Chinese points; the Malay Peninsula, Burma, India; and probably Russia and other countries in Europe, returning to his post in Washington about the end of the year.

Albert Burch, mining engineer, Black Oak Ranch, Medford, Ore., has been appointed as a member of the Oregon State Board of Directors of Higher Education. This board succeeds to the duties heretofore covered by the boards of regents respectively of the State University, the State Agricultural College, and three normal schools. Mr. Burch's appointment was the outcome of a recent move on the part of the Oregon section of the A.I.M.E. to have an engineer placed upon the board of regents of the Agricultural College.

H. Hobart Porter has been elected chairman of the Engineering Foundation, joint research organization of the engineering societies, to succeed **L. B. Stillwell,** who has served in that position since 1925. Mr. Porter was born in New York City in 1865. He graduated from Columbia University in 1886, with the degree of M. E. He engaged in mining engineering in Mexico and Arizona until 1894, when he became a member of the engineering firm of Sanderson & Porter, of New York, with which he has since been identified. At present his interests are largely in power and railroad companies. He is a member of the American Society of Civil Engineers, the A.I.M.E., and the American Society of Mechanical Engineers.

OBITUARY

Water Vaughn Sterling, mining engineer, died in Monterey, Mexico, on Feb. 21 of pneumonia. Mr. Sterling was American consul in Chihuahua City for many years, but since 1919 he had been connected with American Smelting & Refining. His body was sent to his old home, Crisfield, Md., for burial.

Colonel **Joseph T. Crabbs,** president of Granby Consolidated Mining, Smelting & Power Company, died in New York on March 11. He was also a director of Nipissing Mines Company, Ltd. Colonel Crabbs was a native of Indiana, being born there in 1868. He entered West Point in 1887, and was commissioned second lieutenant of cavalry in 1891. He retired from active service in 1908, but during the war returned to the army, serving with the Ordnance Department and being retired in 1918 with the rank of colonel. He is survived by his wife.

Recent Technical Publications

For the Chemist Analyst

METHODS IN NON-FERROUS METALLURGICAL ANALYSIS. *By R. Keffer and C. L. McNeil, with the assistance of Alison Butts. New York: McGraw-Hill Book Company. Pp. 335. Price $4.*

THE authors and editors of this book have succeeded admirably in what they set out to do—to furnish a compendium of analytical methods for the commercial non-ferrous laboratory. It is unusually complete in itself, covering practically all methods needed for such use; and it is gratifying and valuable to find, also, complete references to authoritative sources for details of specialties outside of the usual routine. The arrangement of the book is good and convenient; and, as the preface states, the chapter headings give a summary of methods and of the cases to which each is best adapted, thus enabling a choice to be made. This is followed by general methods, methods for special cases, methods for estimation of traces, and for estimation of impurities in a metal or in substances in which the element in question is the major constituent. Sufficient detail is given under each method and notes as to possible sources of error, and limits of accuracy are given when needed. The methods as stated are, for the most part, those in use in the authors' laboratory at Anaconda, so they can be depended on in detail for the purposes stated. Teachers of students in advanced analytical courses should find the volume indispensable; and it should certainly find its place on the bookshelf of every chemist interested in the lines which are covered. It is a pity that the untimely death of the senior author removed from the profession a chemist of the ability and promise shown in this publication. G. D. VAN ARSDALE.

FLOTATION FUNDAMENTALS, PART 2. *Technical Paper No. 4. By A. M. Gaudin and Paul M. Sorensen. Published by the University of Utah in co-operation with the U. S. Bureau of Mines. Pp. 25. Figures, 21. Price 25c.*

RESULTS of tests on the floatability of pure chalcocite are presented in this paper. Effects of various collectors and common anions were studied, and the observation made that anions forming insoluble copper salts inhibit the flotation of chalcocite. Complete depression of chalcocite was accomplished by the addition of small quantities of thiosulphate, sulphite, sulphide, ferrocyanide, or ferricyanide ions. Some reagents reacted with the collector in such a way as to destroy its usefulness and should therefore be avoided.

The authors point out that the freshness and purity of the mineral used in investigations such as they describe must be known before any dependence can be assigned to results obtained or interpretations made. Differences in the behavior of minerals from different localities, and in different ores, may largely be the result of variations in the freshness or cleanliness of the surfaces of the mineral grains.

AFRICAN MANUAL ON MINING, INDUSTRY AND AGRICULTURE. *1928-29 Edition. Pp. 1361. Edited by C. Carlyle-Gall. Mining and Industrial Publications of Africa, Ltd. Johannesburg. Price 21s. in Africa, 23s. elsewhere.*

FOLLOWING closely on the appearance of the Rhodesian Manual, issued by the same publishers a few weeks ago, the new edition of the African Manual is in every way on a par with it as well as with the earlier edition on Africa. Indicative of conditions in the continent which it covers, almost two-thirds of the volume (819 pages) is devoted to the mining industry, making it essentially a handbook of African mining. Of the balance a considerable portion is devoted to the Rhodesias. A defect is the lack of an index. To be sure, there is a table of contents, but this is not as serviceable as an index would be. The section on mines is arranged in alphabetical order. In its stout binding, its good paper and the excellence of its typography the book is comparable to the others brought out by the publisher.

GEOPHYSICAL PROSPECTING. *Papers and discussions presented at the meetings of the A.I.M.E. held in New York, February, 1928, and at Boston, August, 1928. Published by the American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York. Pp. 676. Price $5.*

IN BRINGING these papers together in this handy volume the Institute performs a valuable service, one that will benefit not only its members but others outside the organization. So widespread is the interest in the subject that many will doubtless be glad to avail themselves of the privilege of purchasing the book at the stated price. The separates are handy at the time of presentation and can easily be slipped into the pocket to be studied at a convenient moment, but for permanent reference this volume of selected papers is much more suitable, more so even than the volumes of the *Transactions* that are issued from time to time. The book is not a textbook of geophysics by any means. Much of the text, in fact, is beyond the ready comprehension of any save the physicist and the competent mathematician. The layman who has heard of geophysical prospecting and would like to investigate the matter further will do better to write to the Bureau of Mines at Washington and ask for the two bulletins already issued by the government on the subject. With the geologist or engineer, the case is different, and it is for him that the Institute has prepared the volume.

A.H.H.

ASBESTOS. Its Sources, Extraction, Preparation, Manufacture, and Uses in Industry and Engineering. *Published by Becker & Haag, Berlin SW1, Germany. Sent free on request to any asbestos producer and manufacturer. Eighty-seven pages of text and over 60 full-page half-tone illustrations and panorama inserts.*

IN PRESENTING this book the company seeks to make those working asbestos in any form or dealing in its products more familiar with its properties. It also wishes to place before the laymen desiring it information as to the origin, extraction and utilization of the mineral. The book has five principal divisions. The first two deal with the mineralogy and history of asbestos. Some 33 pages are next devoted to a discussion of deposits throughout the world, the large deposits of Canada, Russia, and Africa being considered first, following which the smaller beds of Arizona, Cyprus, Finland, Australia, Siberia, China, and the Alps are taken up. The remainder of the text is given over to a discussion of the manufacture of asbestos. The book is beautifully illustrated, as is indicated above, and is well worth the slight effort necessary to obtain it.

In the same connection, it is to be noted that Eldred D. Wilson, geologist for the Arizona Bureau of Mines, has written a bulletin on "Asbestos Deposits of Arizona," which has been published by the Bureau and is available, free of charge, to those writing for it to the director of the Bureau at Tucson. It includes 97 pages and contains seven figures, twelve plates, and numerous tables.

THE STANDARDS YEARBOOK, 1929. *Compiled by the National Bureau of Standards. U. S. Government Printing Office, Washington, D. C. Pp. 401. Price $1.*

PRACTICALLY everything of interest appertaining to standards and standardization is included in this volume, as one familiar with the earlier editions would expect. Those interested in any phase of standardization in the United States or abroad will find the book indispensable. In it current standardization activities and accomplishments throughout the world are summarized in convenient form and brought up to date.

NEWS OF THE WEEK

Summary

INTEREST in the gold mines of Western Australia is being revived. Plans for new developments and for consolidation of old producers indicate possibility of halting decline in output. Page 456.

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Minas de Matahambre has awarded a contract to the E. J. Longyear Company for sinking a new four-compartment shaft to a depth of 2,200 ft. on its properties in Cuba. Page 453.

* * *

U. S. Vanadium has purchased the entire holdings of Standard Chemical in Montrose County, Colo. These properties have produced the largest tonnage of carnotite ores of any American mine. Page 452.

* * *

In spite of revolutionary activities in the vicinity, the Cananea copper district, in Sonora, Mexico, is unusually active. New equipment is being installed at its Cananea-Duluth property by Greene Cananea. Page 455.

* * *

George Graham Rice has been indicted by a United States grand jury as a tax dodger. The government alleges he failed to pay income tax on stock sold in 1925. Page 454.

* * *

Arizona, Utah, and Nevada copper mines have raised wages 5 per cent, effective as long as copper remains above 19c. This follows announcement by Montana mines last week. Page 453.

* * *

Airplanes are being used almost exclusively for transportation of passengers and freight to the new gold field at Bulolo, New Guinea. Page 455.

* * *

J. E. Smith recently addressed the Mining and Metallurgical Society of America on the subject of "The Relation of Credit Supply to the Stock Market." Page 452.

Canadian Institute Meeting at Winnipeg Is Highly Successful

About 350 Members, the Largest Attendance in Several Years, Are Present—Norman Fisher Succeeds R. A. Stewart as President of Organization

By G. C. Bateman
Secretary, Ontario Mining Association

IF SUCH a thing were possible, it might be said that the annual general meeting of the Canadian Institute of Mining and Metallurgy held in Winnipeg on March 6, 7 and 8 had enhanced the reputation of the Canadian West for hospitality. The meeting was a success in every way. The attendance of approximately 350 was the best at any annual meeting for several years. Accommodations were both commodious and satisfactory, the displays attractive, and the technical sessions were exceedingly well attended. This was the first annual general meeting of the Institute to be held in the West, but the visitors found that they had much to learn and nothing to impart as to how things should be done. Even in such small matters as identification badges attention to detail was displayed. A change was made from the conventional type and an attractive badge, made locally, was used, carrying the crest of the Institute in blue enamel and also the crest of the Province of Manitoba.

The meeting was held at the Royal Alexandra Hotel. In the main lobby on the ground floor were valuable and interesting displays of mining machinery, mining and prospectors' supplies, and equipment. On the next floor where the meetings were held were mineral exhibits from Nova Scotia, Ontario, Quebec, Manitoba, Saskatchewan, and Alberta, as well as exhibits, displays and pictures covering the work of the Mines Branch at Ottawa.

Practically all Canadian Institute meetings are held in hotels, and this results in a more informal and more social meeting than is possible under other circumstances. Every room was a social center, with meetings going on all the time, and as there is no legal bar to enjoyment many found that one of the essential requirements was a strong constitution and an ability to get along with very little sleep. In spite of this the technical sessions were interesting and unusually well attended.

An interesting feature of the first evening was a cabaret with dancing between acts. The entertainment was provided by the Junior League of Winnipeg. For the benefit of those who are not familiar with Canadian social life it may be said that the Junior League of the various Canadian cities consists principally of the society debutantes. The smoker, with John Ness as chairman, was an outstanding success. The annual dinner, though not offering the same scope for originality, was also very successful, with Norman Fisher, the new president of the Institute, presiding in his usual graceful manner.

The first session, on March 6, was the business session, the presidential address being given by R. A. Stewart, the retiring president. At this meeting, the first public announcement is always made of the mineral statistics for the preceding year. Dominion figures were presented by S. J. Cook, of Ottawa, and showed that production had again established a new record, with a value of $273,446,864, an increase of 10.5 per cent over the record of 1927, which was the best preceding year. The Canadian mining industry now represents a capital investment of more than $700,000,000. This includes only the money actually spent on the properties for lands, plants, equipment of mines and smelters, and the working cash assets of the operating companies. About 85,000 men are employed in the operating mines and their associated enterprises, exclusive of prospecting and outside development workers, of whom no record is kept. Of the total, metallic production accounted for $131,904,603, or almost 50 per cent. This figure represents an increase of $18,343,573, which is entirely accounted for by copper and nickel, there being an increase of $11,340,000 for copper and $7,000,000 for nickel. Canada is now the world's fourth most important producer of copper, with the prospect of becoming the third largest producer within the next eight or ten years.

At present half of Canada's copper is derived from the mines of British Columbia, one-third from Ontario, and one-sixth from Quebec. The greatest percentage of increase came from Quebec, which in 1927 produced copper to the value of less than $500,000; and for

1928 the value was $4,910,306. The increase in Ontario was $3,800,000 and in British Columbia $2,950,000. The value of fuels produced was $72,995,225, an increase of $1,500,000; and other non-metallics were valued at $18,664,801, an increase of $1,100,000. Clay products and structural materials were $49,882,235, an increase of $5,100,000.

Ontario Output Showed Increase of $10,000,000 in 1928

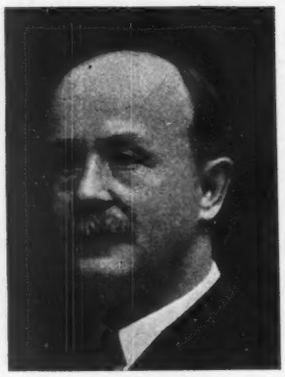
Ontario figures were presented by A. C. Young and showed a total for the province of $100,238,933, an increase of $10,000,000 as compared with the 1927 record. This increase was due largely to metallic production, which had a value of $71,199,917, an increase of $8,500,000. Gold production valued at $32,626,476 showed a decline of $1,000,000, and silver valued at $4,117,652 showed a similar decrease. The increase was almost entirely made up by copper and nickel produced from the Sudbury district. Non-metallic minerals had a value of $7,679,133, and structural materials and clay products were valued at $21,359,783, an increase of $1,400,000.

Quebec production was valued at $29,142,110, which included building materials of $15,382,957. The two principal minerals aside from building materials were asbestos and copper. Asbestos for the year was valued at $11,238,361, an increase of $600,000. Copper was valued at $4,910,306. For the first time in many years there was a substantial production of gold, amounting to $1,240,000, most of which was associated with the copper in the Rouyn ores. Zinc production was valued at $1,276,876, practically all coming from the Tetreault mine, in eastern Quebec.

British Columbia Showed Increase of Nearly $4,000,000 in 1928

British Columbia figures, presented by John D. Galloway, Provincial Mineralogist, showed a total value of $64,685,691, an increase of $3,956,333. Of this amount $48,134,000 was metallic production. The gold production was valued at $4,111,000, an increase of $233,000. Silver production, valued at $6,155,228, showed an increase of $253,000. The chief increase came in the production of copper, however, the output for the year being valued at $14,524,483, an increase of almost $3,000,000. Lead and zinc, on the other hand, showed small decreases, as a result of lower metal prices, and they were valued at $14,535,780 and $8,850,060 respectively. The copper production is the largest for any year in the history of the province and is accounted for by the greater tonnage handled by the Britannia mine, now milling 5,000 tons a day. The outlook for increased lead and zinc production is excellent; the Sullivan mill is being increased from 4,000 to 6,000 tons a day, and many smaller properties are ready to either increase or commence production. An addition is also being made to the zinc refinery at Trail by the addition of another 100-ton unit to be completed early in 1929. This addition will raise the zinc capacity to over 250,000,000 lb. a year.

Among the interesting technical papers presented was one on the "Origin of the Copper Mountain Ores in British Columbia," by Victor Dolmage; and another on "Copper in British Columbia," by J. D. Galloway. A paper on the possible origin of the Frood ore deposit was presented by Dr. C. V. Corless, former general manager of Mond Nickel. Very little has been written on the origin of these ores for several years, but about fifteen or more years ago a great deal of controversy existed between two schools of thought. Dr. A. P. Coleman was the leader of those who favored the theory of magmatic segregation as opposed to the theory of replacement.



C. V. CORLESS

Dr. Corless' paper was a timely contribution, because of the new and important discoveries that have been made in the Sudbury district and also because of the great interest now centered in the mines there. His paper presented the view that as far as the Frood orebody, at least, was concerned, it appeared to result from the relatively sudden injection of a large body of highly fluid magma, very rich in sulphides of iron, copper, and nickel, into the earth's crust along some local and nearly vertical plane of weakness. Such a large body of magma heavily loaded with sulphides incased between the walls of rather low heat-conductivity would probably remain fluid for sufficient time to effect the differentiation with depth which is being revealed by the recent exploration and development. With its heavily concentrated load of sulphides, such differentiation would be very rapid. In accepting such a theory, however, the question naturally arises as to how the sulphides segregated in the original magma, and this has not been satisfactorily explained.

Mineralization at Frood Mine Increases Greatly With Depth

In support of his view Dr. Corless pointed out that in the Frood orebody the upper 800 ft. shows so much rock that, unless the ore is used as a flux for cleaner, it will undoubtedly have to be milled before smelting. At a depth of 800 ft. over 50 per cent is low enough in rock content to be suitable for direct smelting. The smelter grade of the ore between 800 and 1,100 ft. on the Mond property averages 2.1 per cent copper, 2.4 per cent nickel; from 1,100 to 1,400 ft. the rock content is further diminished, the average being 2.1 per cent copper and 2.7 per cent nickel; from 1,400 to 1,700 ft. the rock matter decreases still further and nickel again slightly increases. From 1,700 to 2,000 ft. the combined nickel-copper content is over 5 per cent, the ratio of copper to nickel being approximately 3 to 4. The Mond continued the shaft to 3,350 ft., with levels opened up at 2,800 and 3,100 ft. The average analysis of the ore section developed at 2,800 ft. is only 12.5 per cent insoluble, 7 per cent copper, 3 per cent nickel, and on the 3,100 level, the percentage of the insoluble is only 3.1 per cent, copper is 21 per cent, and nickel 1.7 per cent. Dr. Corless believes that the rich copper ores are the result of settling of the mineral contents in the injected magma. The paper was not presented so much as a definite theory for Sudbury ores, as with the hope of stimulating renewed research and discussion on the origin of these ores.

Emmons Outlines Theory on Ore Deposits in the Canadian Shield

Prof. W. H. Emmons presented a paper on "The Ore Deposits of the Canadian Shield" and outlined the theory, which is not new, that all through the Canadian shield there had been big intrusions of granitic rocks, the upper parts of which had differentiated into basic and acid rocks with the mineral contents settling out in the basic material. Following this, pegmatite dikes were formed, which arose very near the top of the granite bosses. These were subsequently mineralized by the highly volatile mineral solutions originating from the still molten magma much deeper in the mass. Mineralized veins were formed above the tops of the bosses, and their discovery will depend to a very large extent upon the amount of erosion that has subsequently taken place. They will be found in the acid rocks immediately overlying the tops of the bosses, and where erosion has proceeded to the point where the granite is exposed they may be found to a limited extent in the granite itself. If the erosion is carried beyond this point they will be found in the margin in the basic rocks and still lower down in the roof pendants, surrounded by large areas of barren granite. Dr. Emmons was very optimistic regarding the future of mining development in Canada because of the very large number of intrusions. He expects to see great mineral development in that section of British Columbia which lies east of the coastal range.

One of the finest papers presented to the meeting was by Prof. R. S. McCaffery, on metallurgical slags.

J. E. Hammell gave a paper on "Aërial Prospecting" covering the work of the Northern Aërial Minerals Exploration during the last year, and his

paper was illustrated by lantern slides. The conclusion to be drawn from Mr. Hammell's paper was that the value of airplanes in prospecting has been amply demonstrated. This particular company had prospecting parties scattered over all the North country, and it was able to keep in touch with them and bring in supplies entirely by plane. During the last season N.A.M.E. planes covered 100,500 miles, at a cost, including 3 per cent depreciation per month, of 75c. per mile.

On March 9, parties were flown to see the new tin discoveries about 90 miles east of Winnipeg. The original discovery was made only last summer, but already a large number of discoveries have been made over an area embracing a total of 75 square miles. Geological conditions are favorable, and the opinion seems to be that there are very good grounds for believing that commercial deposits may be struck.

Among the American visitors to the Institute meeting were F. W. Bradley, Scott Turner, Prof. W. H. Emmons, and Prof. R. S. McCaffrey.

Gold Hunter to Resume Operations Immediately

OPERATIONS at the Gold Hunter mine, in the Coeur d'Alene district, will be resumed immediately, according to C. K. Cartwright, manager of the company. The entire surface plant at this property was destroyed by fire on Jan. 15. Reconstruction work has been hindered considerably by the extremely cold weather. Development work at the mine is being concentrated on a drift on the 1,800 level, which is expected to strike the original Gold Hunter orebody that was evidently displaced by faulting below the 1,200 level. Production at present is largely from a new oreshoot, which was struck on the 1,200 level and which has been proved to the 1,800 level by a winze.

Italian Zinc Production to Equal Consumption in 1929.

The U. S. Department of Commerce states that the smelters now in operation in Sardinia, at Crotone, and at Vado Ligure, in Italy, will be able to produce about 20,000 metric tons of zinc during 1929. This is the tonnage annually consumed in Italy. Of this total 10,000 tons will be produced at Crotone, 5,000 tons in Sardinia, and 5,000 at Vado Ligure. The production of zinc from additional smelters, construction of which might be contemplated, would imply competition between producers on the Italian market. This is not desired at present by Italian zinc companies. It is stated that when the Raibl zinc mines were granted about seven years ago to a British mining company the ore in sight was sufficient for eight years of operation. At present a tonnage sufficient for operation during the next eight years has been opened up in these mines through the exploration work carried on by the British company. The zinc mines of Sardinia alone are reported to contain ample reserves of zinc ore to cover Italian needs both for peace and war time purposes.

Oil Prospect May Become Lead Mine

After making tests of cores taken from oil wells in the Nigger Creek field, near Mexia, Tex., W. A. Reiter, oil operator and geologist, and B. S. Smith, geologist, have decided to prospect for lead orebodies. A shaft is now being sunk on the Sam Medlock lease.

Plans for International Smelter Now Completed

PLANS for the new International Nickel smelter at Copper Cliff, Ont., have been completed, according to Robert C. Stanley, president of the company. At this plant, which is to be the most modern of its kind, five 1,000-ton reverberatory furnaces and thirty ten-hearth Herreshoff roasting furnaces will be installed. The foundation for the 500-ft. smelter stack has been finished, as are also the foundations for the receiving bins and the crushing and screening plants. Work has been pushed throughout the winter months to permit the erection of steel as soon as possible. To furnish additional water for the concentrator that is to be built to handle the lower-grade ore from the Frood mine, a new pipe line is being laid to Kelley Lake, a distance of about 2 miles.

The surface plant at the Frood mine is practically completed. Hoists and compressors have been installed in the power house. The main hoist will handle skips containing ten tons of ore from the 2,000 level and seven tons from the 2,800 level. The cage hoist can raise or lower 60 men at a time. A change house capable of taking care of 1,300 men is already in use.

Expenditures to date on the Frood development program, since it was started in 1924, have been $10,300,000, and about $14,000,000 additional is estimated as necessary to complete the project. This increase over previous estimates is due to the necessity of providing additional smelting facilities and of increasing substantially the capacity of the Port Colborne refinery.

Development at Old Colony Is Resulting Favorably

Development work at the Old Colony mine, in the Kingman district of Arizona, has disclosed about 100,000 tons of silver-lead-zinc ore, estimated to average $30 a ton, on the 4,500 and 4,800 levels. Four tunnels, 300 ft. apart, have been driven at the property. The raise from the 4,500 to the 4,700 levels is now being completed. A raise has already been driven between the 4,200 and 4,500 levels.

New Cornelia to Resort to Underground Operations

DEVELOPMENT WORK undertaken at the property of New Cornelia Copper, at Ajo, Ariz., has shown the existence of two separate orebodies. From one of these a substantial tonnage will be extracted by underground operations, according to Gordon R. Campbell, president of the company. During the last two years an extensive drilling campaign has been conducted to determine the extensions of the known ore, both vertically and laterally. The large prospective tonnages that have been proven by this work justify increasing milling capacity.

About 30,000,000 tons of ore averaging about 1.2 per cent copper has already been extracted at the New Cornelia operations. All of this has been from the open-pit operations. However, the company has done some shaft sinking for the purpose of obtaining water.

The changes now being made in the concentrator will give that plant a capacity of 10,000 tons of ore daily. As the carbonate ores, now being treated at the leaching plant, are nearing exhaustion, three additional units will be added to the mill, giving it an eventual capacity of 15,000 tons. During 1928, the concentrator treated an average of 7,070 tons daily.

Asbestos Corporation Makes Diamond Drilling Contract

The Asbestos Corporation of Canada has let a contract to the Sudbury Diamond Drilling Company, for 60,000 ft. of diamond drilling on the corporation's property at Thetford, Que. It is estimated that a year will be required to complete the work, which will be started as soon as possible. Ten new drills have been ordered for shipment to Thetford immediately.

Empire Mines Acquires Mossback, Near Kingman

Empire Mines Consolidated, which is backed by Canadian capital, will develop the Mossback property, near Kingman, Ariz. Recent development work on the 400 level of the 700-ft. shaft at the property, undertaken in what was practically virgin ground, disclosed an orebody 170 ft. long. At places this orebody is 30 ft. wide. It carries mill-grade gold ore. E. E. Campbell is consulting engineer for the company.

King of Pine Creek Will Sink Shaft

A shaft 250 ft. deep will be sunk from the main tunnel at the King of Pine Creek silver-lead mine, in the Cœur d'Alene district. It is already 30 ft. deep and is being sunk 5 ft. a day. The company expects to cut the vein at a depth of 200 ft.

Credit and Stocks Discussed Before M.&M.S.A.

THE supply of credit in the financial system partakes of the nature of a gas: it tends to expand to fill completely the container, according to Edgar L. Smith, president of the Investment Managers' Corporation, and author of "Common Stocks as Long-Term Investments," who spoke at the Harvard Club on March 7, before the Mining and Metallurgical Society of America. His subject was "Relation of Credit Supply to the Stock Market." Just at the present time the container of credit in the United States is unprecedentedly large, but the supply has expanded correspondingly. When the supply of credit is large, prices of something must advance. Observers have in the past concentrated on the price level of commodities, believing that so long as it did not become exorbitant the situation was sound. More recently, however, they have begun to realize that stock-market prices have been inflated as a consequence of the vast amount of credit available. Which phenomena is the cause and which is the effect is difficult to determine. Probably a circle is formed—the expansion of credit stimulates the advance in security prices; and the advance in security prices increases still more the demand for credit. At any rate, it can be demonstrated that during the last eight years the trend of both these functions—security prices and credit supply—has been steeply upward and that to a remarkable degree the trends have paralleled each other.

Mr. Smith did not attempt to forecast what the ultimate outcome of this inflation would be. He characterized the Federal Reserve Board as observers of what was going on rather than controllers of the situation. He did express the thought, however, that sooner or later there must be a reversal of the trend.

H. G. Moulton presented a paper entitled "Twenty-one Years of Copper Convertibles," in which he traced the history since 1908 of eighteen convertible bond issues floated by important American copper-mining companies. He showed how the investor without detailed information as to the merits of the individual enterprises might have profited by investing $1,000 in each of these issues as they came along. At the end of 1928, an investment of $18,000 would have produced $104,142 had the various privileges of conversion been exercised on each of the issues. Had the corresponding sums been invested at corresponding dates with interest compounded at 4 per cent, the value would have been $32,457. Mr. Moulton pointed out that during the last year the information in his paper had been rapidly becoming more and more obsolete, owing to the ascendancy of common stock issues to the almost complete exclusion of bonds. However, he felt that in the course of the business cycle the time would again come when mine financing through the issue of bonds would be considered useful.

H. Foster Bain, H. B. Fernald, and H. T. Hamilton joined in the discussion and propounded a number of questions that Mr. Smith answered. Percy E. Barbour, in the absence of G. Temple Bridgman, president of the society, acted as chairman of the meeting.

U. S. Vanadium Obtains Radium Property

U. S. VANADIUM has acquired the entire Paradox Valley holdings of the Standard Chemical Company. These holdings include a mill site and 225 mineral claims, more than 4,000 acres in extent, in the western part of Montrose County, Colo. Radium has been extracted from this district, but operations have been discontinued for some time, the entire world's production of the metal now coming from the Belgian Congo. The U. S. Vanadium Company has large vanadium holdings in Colorado and operates a mine and mill at East Rifle Creek, Colo.

Standard Chemical has been the largest producer of carnotite ore in the United States. The company is said to have expended $5,000,000 in its effort to produce radium profitably. Up to 1921, production was about 38,000 tons of ore. The mill was shut down in the latter part of 1922. It has a capacity of 90 tons daily.

Lack of Water Temporarily Stops Champion Exploration

Diamond drilling has been temporarily suspended by Champion Copper in its exploratory tract, owned jointly by Copper Range and St. Mary's Mineral Land, because of lack of water. A small lake near the operations, which are in the Michigan copper area, has been pumped dry, and probably two weeks' delay will ensue before work can be resumed. Copper in the Ashbed formation was indicated in both drill holes.

Form Two New Alaska Companies

Conrad Wolfle, mine operater, of Spokane, Wash., has organized a company to take over and develop the Cantu mine, on Salmon River, Alaska. This property was formerly under bond to Premier Gold Mining, which did considerable work before abandoning it.

Port Wells-Granite Mining has been organized in Tacoma, with L. A. Levensaler as vice-president, to reopen the Granite mine, a gold property near Port Wells. This property was operated prior to the war and had a total production of $277,000.

Fire Destroys Most of Rossland's Business Section

THE business section of the historical old city of Rossland, B. C., was practically wiped out by a fire on the night of March 1 and the following day. Because of the unusual severity of the winter, the water mains had been frozen for some five weeks before the fire, and citizens have had to "pack" water for domestic consumption from the railway tank and other places. Consequently, when the fire broke out and the firemen had exhausted their supply of chemicals they were practically helpless and could do little more than watch the fire burn itself out.

Rossland, the first large lode mining camp in British Columbia, has ceased to be a mining camp and has become a suburb of Trail. Workmen's trains and buses ply between the two towns, and a large number of the employees of the smelter make their homes in Rossland. The city will therefore be rebuilt and the old wooden frame buildings will be replaced by structures of a more substantial character.

Wisconsin Offers Five Fellowships in Engineering

FIVE fellowships in engineering are being offered at the University of Wisconsin for 1929-1930. These include three university fellowships, available to graduates of engineering colleges, and two research fellowships. The university fellowships are for periods of one year and the research fellowships are for two years. Appointments will be made April 25 and applications should be received not later than April 15. Application blanks may be obtained from Dean F. E. Turneaure, College of Mechanics and Engineering, or Dean C. S. Slichter, Graduate School, University of Wisconsin, Madison, Wis.

Comanche to Use Electric Equipment in Mine

Mine development at the property of Comanche Mining & Reduction, at Blind Springs Hill, Mono County, Calif., is being pushed, and plans are being made to electrify operations at the Kerrick shaft and in the Ross adit of the company. Tests of run-of-mine ore are also under way. The company is continuing its shipments of high-grade gold ore.

C. & H. Opening Good Ground North of No. 3 Tamarack

At Calumet & Hecla Consolidated, in the Michigan copper district, important areas of good ground are being opened in the conglomerate north of No. 3 Tamarack shaft and the slope shaft in the Red Jacket shaft branch. This is virgin territory. Drifting is proceeding on the 11 level of No. 3 Tamarack, and preparations are being made to start another drift, probably on the 18 level.

Portion of mineralized zone on the Victoria group, near Smithers, B. C., where Lorraine Copper-Silver is undertaking development

Lorraine Copper-Silver to Crosscut to Main Vein

CONTINUATION of the crosscut at Lorraine Copper-Silver, which is developing the Victoria Basin group, in the Babine Range, near Smithers, B. C., to intersect the main vein is planned by the company. This crosscut recently intersected a new vein of gold-silver ore, which has been followed for 20 ft., with the face still in ore. In addition to continuing the crosscut, drifting is to be started on the new discovery. The company now holds approximately 500 acres, in ten separate claims. It proposes to acquire about 100 additional claims, north and south of its present holdings, and to form a large corporation with a dominion charter and capitalization of about $10,000,000. This summer, work will be centered on opening up the orebodies as much as possible. Some diamond drilling will also be undertaken.

Utah University Offers Five Fellowships in Mining and Metallurgy

THE department of mining and metallurgical research of the Utah Engineering Experiment Station, University of Utah, is maintained in co-operation with the Intermountain Experiment Station of the U. S. Bureau of Mines. Five fellowships will be offered by this department for the year 1929-1930 and they are open to college graduates who have had the proper training in mining, metallurgy, or chemistry, and who are qualified to undertake research work. The income of each fellowship is $720, beginning July 10 and ending June 4. Fellows are exempt from all university fees, except the general student body fee, the payment of which is optional.

Fellows will register as students in the department of mining and metallurgical research of the University of Utah and become candidates for the degree of master of science (unless this or an equivalent degree has been earned). Their class work in the university will be directed by the heads of the departments of instruction, but the greater part of their time will be spent in research work, on the problem assigned to them, under the direction of a member of the staff of the Intermountain Station of the Bureau of Mines or the department of mining and metallurgical research.

The purpose of this work is to undertake the solution of definite problems confronting the mining and metallurgical industries. For 1929-1930, fellowships will be granted in the following subjects:

1. Mining Problems.
   - (*a*) Ventilation Problems.
   - (*b*) Geophysical Prospecting.
   - (*c*) Subsidence Problems.

2. Microscopic Investigations in connection with the milling (Crushing and Grinding and Flotation) and subsequent metallurgical treatment of copper, lead, and zinc ores.

3. Crushing and Grinding Problems.
   - (*a*) Elutriation Problems.
   - (*b*) Crushing Resistance of Minerals.

4. Flotation. Fundamentals on flotation of pure minerals and gangue constituents.
   - (*a*) Physical-chemical Investigations.
   - (*b*) Experimental Investigations.

5. Pyrometallurgy. Problems met with in the smelting of complex lead-zinc ores.

6. Hydrometallurgy. Problems met with in the leaching of lead and zinc ores.

Applications, with a certified copy of collegiate record, statement of experience, and names and addresses of three references will be received up to May 15, 1929. Further information in regard to these fellowships will be furnished to those desiring the same. Applications should be addressed, Director, Utah Engineering Experiment Station, University of Utah, Salt Lake City, Utah.

Matahambre Will Sink New Four-Compartment Shaft

MINAS DE MATAHAMBRE, subsidiary of the American Metal Company, has awarded a contract to E. J. Longyear Company, of Minneapolis, for a new 2,200-ft. shaft on its copper property in the province of Pinar del Rio, 100 miles west of Havana, Cuba. The specifications call for a four-compartment, steel timbered, vertical shaft to be sunk from the surface. The contractors will send a crew of 34 men, sailing from New Orleans on March 30. This company sunk the new Warren shaft, at the Copper Queen mine, Bisbee, Ariz. Operations at Matahambre are now on a basis of about 1,000 tons daily. Production is about 18,000 tons of copper a year. Ore reserves are estimated at more than 900,000 tons.

Arizona Copper Mines Increase Wages 5 per Cent

WAGES at Arizona copper mines in the leading districts of the state—Bisbee, Miami, Jerome, Morenci, Ajo, Ray, and Superior—have been increased 5 per cent, effective as long as copper remains above 19c. a pound. Since October, the Arizona mines have declared increases totaling 20 per cent over wages before that date. This compares with increases of $1 per shift in the Montana mines. According to the report of the state mine inspector, recently issued, 11,624 miners were employed in Arizona, most of them in the districts mentioned above. In addition, mill and smelter employees must be considered, making the total number of men affected well over 15,000.

Wages have also been increased at the Utah Copper and Nevada Consolidated properties in Utah, Nevada, and New Mexico.

California Tax Bills Passed

On Feb. 27, 1929, the California Legislature passed the Nelson bill, providing for a tax of two mills on each dollar of actual value of intangible securities such as notes, bonds, deeds of trust, mortgages, and like securities, and in addition a one-mill tax on solvent credits. The Nelson bill providing for a 4 per cent net income tax upon corporations and business organizations of the state was likewise passed. No change was made in the valuation or depletion plan for mines as previously recorded in news items.

Butterfly Developing Claims Near Ophir, Colo.

OPERATIONS at the property of Butterfly Consolidated, at Ophir, Colo., in the San Juan basin, are now centering on development work to prove additional ore for the 100-ton mill, which was started last summer. The property consists of 49 mining lode claims, totaling approximately 450 acres in extent.

Development work to date consists of more than 12,000 ft. of underground workings on four levels, including shafts, raises, chutes, and winzes. No. 3 tunnel has been extended about 300 ft. to the southeast on what is known as the Duffy vein. Two stopes have been cut and a third stope is now being opened. At a distance of about 1,500 ft. from the portal of this tunnel, a crosscut has been driven to the north to cut the Zuma and Milwaukee veins. Work was discontinued last November, after driving 265 ft., but it is now being resumed. The company estimates that 65 ft. remain to be driven before the Zuma vein is cut.

Operation of the mill has been intermittent because of mechanical difficulties and lack of sufficient development in the mine, according to M. E. Binner, secretary of the company. About 147 tons of concentrate have been produced, containing gold, silver, lead, and copper.

Rice Indicted for Dodging Income Tax

GEORGE GRAHAM RICE, who was convicted and sentenced to the Atlanta penitentiary for four years for using the mails with intent to defraud, in the recent Idaho Copper trial, was indicted on March 7 by the United States grand jury as a tax dodger. The government alleges that he should have paid $453,949.97 income tax in 1925. He is charged with having sold shares of Idaho Copper for $2,117,518.57, for which he is alleged to have paid $384,580. The indictment also charges Rice with being a "wilful" tax dodger and with attempting to "evade and defeat payment of his income tax."

Although Rice was convicted last December, he has managed to stay out of jail by furnishing $15,000 bail and filing preliminary papers to bring his conviction before the U. S. Circuit Court of Appeals. About a month ago, complaints were lodged against him by Post Office inspectors, and he was admonished by Judge John C. Knox to abstain from stock promotion schemes.

Van Dyke Makes Good Progress in Unwatering

Unwatering of the Rice shaft of the Van Dyke Copper Company at Miami, Ariz., has been completed to a depth of 200 ft. below the 1,200 level. The station and drifts at this level were found in good condition after the removal of the water. Air and water lines are being extended to the 1,200 stations, and drifting will soon be started.

Propose Formation of an Institute of Industrial Co-ordination

AT A MEETING in Washington on March 5, a special advisory committee, under the chairmanship of B. C. Forbes, arranged a tentative program for the movement on industrial co-ordination. A resolution was adopted requesting Manny Strauss to organize a committee representing American industry for the purpose of doing the preliminary work toward founding an "American Institute of Industrial Co-ordination." The membership of the committee which met in Washington included representatives of public utilities, railroads, labor, and various branches of industrial and labor institutions.

It was explained that the movement for industrial co-ordination originated in an article in Mr. Forbes' magazine, but that the practical possibilities of the idea were not realized until a large number of indorsements began to come in to the editors from industrial leaders. Because of the enthusiastic manner in which industry received the idea, Mr. Forbes has determined to see how far it can be carried out. There is no intention on the part of Mr. Forbes, however, to control or direct the movement, it was stated. The only purpose of the Forbes organization is to get the movement carried to the point where industry itself will take hold and complete the work.

Among the important points to be taken up are the stabilization of prosperity, the leveling of the peaks and valleys of employment, and the determination of labor's part in the program of co-ordination. Attention was called to the statement of Benjamin Javits, a trade association attorney and a supporter of the movement, that the only means of solving the problem is for industry to organize to discover and give voice to its needs. The suggestion was made, however, that amendments to the Sherman Act and an enlargement of the facilities of the Federal Trade Commission would promote the movement, although the basic laws relating to industrial co-ordination must be worked out by industry itself.

Among those who have shown an interest in the conference, the Forbes organization states, are: Albert L. Couzens, vice-president, Highland State Bank; B. F. Fairless, president, Central Alloy Steel Company; E. A. Filene, president, Filene Department Stores; H. J. Fisher, chairman, McCall Corporation; Irving S. Florsheim, president, Florsheim Company; B. B. Greer, president, New York Air Brake Company; Louis Guenther, *Financial World;* George E. Hardy, president, Commonwealth Power Company; Henry Ittleson, president, Commercial Investment Trust; Albert C. Lehman, Blaw-Knox Company; Norman Lombard, Stable Money Association; E. L. Marston, chairman, Texas-Pacific Coal & Oil Company; James M. Matthews, chairman, Babson & Company; James H. Post, chairman, Cuban-American Sugar Company; Franklin Remington, chairman, the Foundation Company; F. W. Sargent, president, Chicago & Northwestern Railway; Paul Shoup, president, Pacific Electric Railway Company; W. W. Atterbury, president, Pennsylvania Railroad; and William Green, president, American Federation of Labor.

To Start Milling at Gaston Mine of Rescue-Eula

DEVELOPMENT of the Gaston gold mine, near Washington, Calif., by Rescue-Eula Mining is progressing satisfactorily, according to O. E. Schiffner, general manager of the property. Stoping of ore is in progress, preparatory to starting operation of the 70-ton mill about May 1. The shrinkage system is used at this property, which consists of 22 mining claims and patented timber lands, totaling more than 1,000 acres in extent.

The orebodies occur in a contact between granite and slates, as well as in quartz veins in the granite itself. Most of the production of about $2,000,000 has come from the contact veins. The property has been opened up to a depth of 1,900 ft. on a dip of about 50 deg. It was operated from the early 'sixties until the end of the World War, when it was closed because of lack of efficient labor.

Operations are conducted through several tunnels. The lowest of these, about 4,700 ft. long, taps the vein system about 4,500 ft. from the portal. About 1,000 ft. of drifting on the contact vein on this level has been accomplished. Mill-grade ore has been exposed for about half this distance, ranging from 3 to 10 ft. in width. In workings above this level, orebodies attained a width of 25 ft. or more in places, and the company hopes to find bodies of similar width on this level.

Rescue-Eula started its present development program about eight months ago. The property is operated with water power, under 1,170-ft. head.

Ask for Change in Age Limit at Michigan Mines

As the result of a mass meeting of mine employees of the Michigan copper district, a petition will be forwarded to the state labor commissioner with the intention of making a change in the existing labor law so as to permit a large number of idle youths, between the ages of sixteen and eighteen, to work in the mines. Because mining is placed in the "unduly hazardous" class, the mining companies cannot employ young men until they are eighteen years old.

Airplanes Used Almost Exclusively in Supplying New Guinea Gold Field

THE secretary of Guinea Airways, Ltd., reports considerable activity at the Bulolo gold field, in the mandated territory of New Guinea. The population at the gold field is being supplied almost entirely by airplane transportation, for which work Guinea Airways, Ltd., is using five machines. Two of these, in favorable weather, in addition to carrying passengers, can transport as much material in one week as 75 native laborers could in three years. Since aërial transportation was introduced into the territory in April, 1927, the heavy cost of preparing and maintaining public airdromes has been borne by private companies. Steps are being taken to arrange for this responsibility to be taken over by the government. Present landing grounds are in heavily timbered, mountainous country, which is subject to tropical rainfall.

Recruiting expeditions to obtain 2,000 native laborers for the gold fields at a cost of £30,000 have been sent out under instructions from a London company, and a sufficiently large number of white men to control this labor force has been engaged to supervise and direct operations.

Fourteen Fellowships Offered at University of Illinois

TO ASSIST in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen research graduate assistantships in the engineering experiment station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

Research work and graduate study may be undertaken in architecture, architectural engineering, ceramic engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, physics, railway engineering, and theoretical and applied mechanics.

Additional information may be obtained by addressing the director, Engineering Experiment Station, University of Illinois, Urbana, Ill.

Errington Orebody Proven for Length of 11,000 Ft.

At the Errington mine of Treadwell-Yukon, in the Sudbury district, northern Ontario, ore has been encountered in the crosscut in the Bradley section, north of No. 3 shaft. The length of the proven ore under actual development now extends 11,000 ft. east of the original discovery. Diamond drilling has been started from the 500 level at No. 2 shaft to test the continuation of the orebodies in the central section of the mine at depth. The mill is now handling about 270 tons of ore a day, from which approximately 40 tons of concentrate are being made. Some metallurgical problems have yet to be solved, but officials believe that the present recovery of about 60 per cent will soon be increased to 70 per cent or more. Proceeds from the sale of the concentrate are paying for mining, milling, and part of the overhead.

Alabama Has Four Mining Fellowships Available

THE School of Mines of the College of Engineering of the University of Alabama offers four fellowships in mining and metallurgical research, in co-operation with the U. S. Bureau of Mines. These fellowships are open to graduates of universities and engineering schools who have proper qualifications to undertake research investigation. The value of each fellowship is $675 per year of nine months, beginning Sept. 1, 1929.

Applicants should send a copy of their collegiate records from the registrar's office of the institution where they have graduated. They should also state their professional experiences and give the names and addresses of at least three persons who are familiar with the training and ability of the applicant. Letters of recommendation will be welcomed. Applications are due not later than June 1 and should be addressed to J. R. Cudworth, Acting Director, School of Mines, University of Alabama, University, Ala.

Strike Rich Ore in Centennial

High-grade ore was recently encountered in the Conrad vein of the old Centennial mine near Auburn, Placer County, Calif. Ira Thorp, who is working the property under lease, has mortared out by hand approximately $3,000 in drifting 45 ft. on this ore shoot. The breast of the drift is still in ore. The ore was encountered at a depth of 250 ft. in a 500-ft. tunnel, which cut the vein at 350 ft.

Cananea District Active in Spite of Revolution

MUCH NEW ACTIVITY is reported in the Cananea district, Sonora, Mexico, despite the revolution now taking place in that country. Greene Cananea is installing a new hoist and equipment in its Cananea-Duluth mine. This mine has been developed to a depth of 600 ft., and has had a large production record in the past. About two miles from the Cananea-Duluth, a 1,000-ft. shaft is to be sunk on Sonora hill, which was churn drilled about six years ago. This shaft will be at the end of the known ore horizon of Greene Cananea. High-grade ore now blocked out in the Colorada mine of Greene Cananea is reported to be sufficient to produce 10,000,000 lb. of copper per month for the next eleven years. Large quantities of concentrating ore have also been developed. The ore zone is more than 8 miles long.

To the south of Greene Cananea, Democrata Mining has been diamond drilling with reported good results. In former days the company produced 1,000 tons of ore per day from its property of only forty acres. It has now enlarged its holdings by acquiring several thousand acres to the south of the Greene Cananea boundary. Adjoining Greene Cananea on the north is the North Cananea property, also under development. Butte Cananea Mining is reported to be about to start development of the Santa Barbara property, which carries silver-gold-copper ores. The Silver Plume property is preparing to erect a mill. The ores are silver-lead.

Novel Hydraulic Method Used Near Fairbanks

A NOVEL METHOD of hydraulic mining is being used on Eldorado Creek, Fairbanks, Alaska, by Sylvester Howell, who is operating the Burns claim. A shaft has been sunk to a depth of 200 ft. into pay gravel, which has been drifted on to make room for a string of sluice boxes. As operated, a centrifugal fire pump forces the water through a nozzle against the face of frozen material, mostly sand. The water and tailing are collected in a sump, the water being pumped off and the tailing hoisted up the shaft. The plant is operated by a battery of four steam boilers, using coal as fuel, but Mr. Howell is planning to substitute Diesel engine power. This operation is said to be a financial success.

Alaska Juneau Bonds Stampede Group

Alaska Juneau Gold has bonded the Stampede group, at Rainy Hollow, B. C., for $100,000, and will proceed with the development of the property. It is located near the boundary between British Columbia and the Yukon Territory. The ore is gold.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Interest Is Being Revived in Western Australia's Gold Resources

Melbourne, Jan. 30, 1929.—Mararoa Gold Mining, after a prosperous career at its Norseman mine, is now developing a mine at Reedy's, near Cue, Western Australia, but has been hampered by lack of sufficient capital. H. E. Vail, general manager of Lake View & Star, who is also associated with Wiluna Gold, has taken a short option with a view to interesting London investors in the property. According to the present plans, Mararoa will receive 72,500 fully paid shares of £1 par each in a company with a nominal capital of £275,000. The orebody is exposed for approximately 400 ft., with a width of from 6 to 8 ft. The average value of the ore to a depth of 500 ft. is 40s. per short ton. Indications in the deepest hole, which intersected the lode at a vertical depth of 503 ft., are that grade is improving with depth. The metallurgical examination of ore from the mine, made at the Kalgoorlie School of Mines research laboratory, shows that the sulphide ore is amenable to simple amalgamation and cyanide treatment, with high extraction and low cyanide consumption. That the oxidized ore is amenable to the same treatment has been amply proved by the mine's treatment results. The ore opened up and indicated by diamond-drill holes amounts to about three years' supply, at 3,000 tons per month.

WITH gold mining on the Kalgoorlie field at a low ebb, announcement by F. G. Brinsden, general manager of South Kalgurli Consolidated, that his company had arranged with North Kalgurli to work the Croesus Proprietary property on a profit-sharing basis is an encouraging sign of general revival of interest in the field. Croesus Proprietary contains a large quantity of ore estimated to be worth 29s. 6d. a ton, and although it will have to bear the cost of transportation to the mill, the management is doubtless satisfied that the ore can be treated profitably.

Another project under consideration is for the amalgamation of the Lake View & Star group with the adjoining Golden Horseshoe. At present the former company is developing its Chaffers lease from the Horseshoe shaft. The Horseshoe company was reconstructed financially last year, and the capital necessary for development was reported to have been subscribed. Little news of future intentions has been forthcoming, however. This is probably explained by the negotiations now proceeding.

Following the increase in the capital of Mount Elliott, Ltd., Queensland, to £1,750,000, the directors have invited shareholders to subscribe for 800,000 preferred ordinary shares of 10s. each at par. The issue has been underwritten by the New Consolidated Goldfields, Ltd., London. In a circular to shareholders the board claims that concessions granted by the Queensland government will enable working costs to be kept at a low figure, and that an option, which becomes an absolute purchase when the new capital has been allotted, over the mines, plant, machinery, and stores of the Hampden Cloncurry Copper Mines, Ltd. (in liquidation), will enable production to be commenced this year instead of in 1930, as was stated previously. With copper at present prices, a profit of £250,000 is anticipated on the first year's work.

Princeton Geology Students to Travel Through Canada

PLANS for the most extensive trip into Canada ever undertaken by the Princeton summer school of geology are taking form under the direction of Prof. Richard M. Field. A study will be made of the natural resources and geological features of the country traveled through on the 11,000-mile journey, which will last six weeks.

The train includes besides Pullman cars for living quarters a specially constructed classroom and laboratory car to facilitate the study of geology along the way. It will head north into the New England States and into the Maritime Provinces of Canada. The party will have the co-operation of the Canadian Geological Survey and Department of Mines.

The trip will cross Canada, stopping at various places of interest, including an examination of the deposits in the Rouyn mining area in Quebec. Inspection of gas wells in Calgary, a survey of the agricultural and wheat districts and an inspection of the Cretaceous coal beds in Alberta will be included. The structural geology of the Canadian Rockies, especially around the Jasper Park region and at Banff and Lake Louise, also will be studied.

On the return trip the students will travel through Canada, swinging down into the United States through Minnesota and traveling through Pennsylvania back to Princeton. Last year the party was made up of students from Princeton, Manchester University, Oxford, Cambridge, Cornell, Pennsylvania State College, Williams, and Columbia.

New York Section to Be Addressed by O'Shaughnessy

On March 28, the New York section of the A.I.M.E. will meet at the Machinery Club for the installation of new officers, including R. M. Roosevelt, the new chairman of the section. Michael O'Shaughnessy, editor of "O'Shaughnessy's South American Oil Report," a monthly publication, will address the section on "Oil in South America."

Mexico City Letter

By W. L. Vail
Special Correspondent

Convention on Mining Legislation Is Postponed by New Revolution

Mexico City, March 4, 1929.—Breaking out of a new revolution on the morning of March 3 has automatically postponed the convention of miners which was soon to have been held in this city for the purpose of discussing proposed changes in the present mining laws. No attempt will be made to convene until normal conditions have been restored. At this writing, an estimate of the following the revolutionists have is impossible, but the government is evidently confident that it will be able to restore order and establish control in the affected regions within a comparatively short time. However, should the movement spread it would greatly affect mining operations, as most of the railroad facilities would have to be commandeered for troop movements.

REPORTS from Coahuila state that mining activity throughout the state has become decidedly more pronounced within the last ninety days. In addition to the new lead smelter to be built by Mazapil Copper at Concepcion del Oro, and the opening up of several properties near the Coahuila-Zacatecas border by San Antonio interests, a score of smaller developments are cited.

Mexico Mines of El Oro has asked for the necessary permit to shut down at its mine near El Oro. This company will continue to operate its property in Catorce, San Luis Potosi. In addition, treatment of the tailing pile, estimated to contain 1,200,000 tons of $3 ore, will be undertaken. A preliminary plant with a capacity of 100 tons daily has been built. If operations are successful, this will be increased to 1,000 tons daily.

Mexico Mines of El Oro was incorporated in 1904, with a capital of £180,000. Production began in 1907, with a 40-stamp mill and cyanide plant. In 1914, the capital was increased to £210,000 to acquire the properties of the Compañia Miniera de Oro Nolan. Dividends paid to date amount to 11,713 per cent on the original capital. In March, 1928, capital was still further increased to £1,000,000 to acquire large tracts of land in Brazil.

Mexican Mines Recovery, a new American organization, has been formed to acquire mining properties in Mexico. This company's operations will be confined to reopening old properties, according to report.

A. S. & R. officials have recently denied rumors which have been published in local papers to the effect that a sensational strike has been made on the mother lode at Cerro de San Pedro, where the company has extensive operations.

MARKET AND FINANCIAL NEWS

Copper Company Executives Comment on Market Outlook

Ryan and Vogelstein Optimistic Regarding Future

DURING the last few days two leading copper company executives have released significant comment on the present copper market situation and the outlook for the future. John D. Ryan, Anaconda board of directors chairman, revealed his opinions on the subject in a communication made available with the announcement of the Anaconda stock-rights issue. A published interview with Ludwig Vogelstein, chairman of the board of American Metal Company, on the general situation in copper, was released through the Dow-Jones News Service last week. Both opinions are decidedly optimistic as regards the future.

Mr. Ryan said that he did not think there had been such a runaway market in copper as many had stated, as a price of 20c. a pound for copper would be only 20 per cent above the average for the ten years ended with 1916, and would be only 25 per cent higher than for 1913, when the price of copper averaged 15.7c. per pound. The advance in price of copper was still less than the advance of the leading world commodities above their price for the corresponding periods.

At the present time every copper mine in the world is, in Mr. Ryan's opinion, producing all the copper that it is capable of turning out with present equipment and labor. The present demand for copper is the most substantial that the industry has ever seen. Since the general use of copper in electricity began, the increase in copper consumption of the world has been 6 per cent cumulative a year. Twenty years ago the annual increase in world demand amounted to about 75,000,000 lb. Now it takes 250,000,000 lb. a year to satisfy new demand for copper. Smaller producers that may come into production on account of the increased price of copper will not have much effect on the market situation, for, so far as Mr. Ryan can see, consumption will take care of all prospective production as fast as it comes in. He said that the African properties would be important producers in time, but pointed out that it takes ten years to bring a large copper mine into production, adding that Katanga, which is 25 years old, is the only important producer in Africa at present, with the others still years away from production.

Concerning the possibility of exhausting copper supplies of this country, he said that as yet none of the great mines of copper are showing any signs of reduction. Recovery of copper is at present one-fifth more than twenty years ago, as now about 90 per cent of the copper in the ore is saved, compared to less than 75 per cent at that time. This, he said, was aiding materially in lengthening the life of present reserves, adding that no doubt other great mines would be discovered in the future.

Vogelstein Believes Price Can Be Maintained

Mr. Vogelstein is decidedly optimistic regarding the ability of producers to hold the price of copper around the 19½c. per pound level. He believes that there is sufficient copper around to prevent the price from advancing materially above its present level if consumers keep their heads. He considers that good consumption of copper is assured to the end of the third quarter of 1929, so that there should be no decline in price, at least until fall.

Mr. Vogelstein does not look for any material increase in rate of world copper production this year. Practically all the companies are operating at 100 per cent of capacity, and it may prove difficult for all of them to hold at that rate continuously. He therefore was inclined to believe that world copper production for January and February would prove to be a peak for the year, although there was a possibility that output might be at slightly higher rate during the last month or two of 1929. Under such conditions Mr. Vogelstein does not see any great danger of overproduction this year.

In regard to the African output of copper, he said that no copper was to be expected to come on the market from the newer producers until along in 1931. Of the newer producers, Roan Antelope will be the first to put copper on the market, with output commencing in 1931 and gradually working up to a rate of 100,000,000 lb. of copper a year. In the next two years after that two other producers, with an annual output of around 100,000,000 lb. of copper a year each, should be brought in. Then output will gradually increase, he said, until in about ten years from now output from the new copper producers in Africa will be around 500,000,000 lb. of copper a year. Elaborating on this, Mr. Vogelstein stated there are, according to present developments, four major producers in the making in Africa other than Katanga. These are Roan Antelope, the N'Kana property of Bwana M'Kubwa, Mufulira, and N'Changa. Only Roan Antelope among these is as yet installing equipment and getting ready for production. The others are still drilling and exploring their orebodies, and it must be remembered that it will take much time and a great deal of money to bring these mines into production.

In regard to Canadian production, Mr. Vogelstein explained that the Frood mine of International Nickel Company would increase the copper output of that company this year about 40,000,000 lb. above that of 1928, but that International Nickel's Frood mine would not be producing at a maximum until 1931. He believes that the output of the Canadian as well as of the African mines would be needed to meet the increase in world consumption of copper by the time that the various new outputs become available.

Record Chilean Nitrate Output

Chilean nitrate production set a record in 1928, according to the U. S. Department of Commerce. Output reached 3,163,000 metric tons—100,000 tons more than in 1917, the previous best year for the industry, when demand was abnormal owing to unusually large military requirements.

December, 1928, nitrate of soda output was high, totaling 293,600 tons, compared with 233,800 tons in December, 1927. Exports, also high, amounted to 342,100 tons, compared with 302,600 during the corresponding month in 1927.

World stocks of nitrate of soda were 2,133,200 metric tons at the end of 1928.

Transvaal 1928 Production Sets a New High Record

December's output of Transvaal gold was declared by the South African Chamber of Mines, on Jan. 10, as 859,761 oz. valued at £3,652,033. The total gold output of the Transvaal for 1928 thus amounts to 10,358,596 oz., valued at £43,571,140. This annual output forms once more a record, the above figures exceeding those of 1927 by 227,966 oz., or £1,117,953 in value.

Anaconda Stock Rights for Bond Retirement

DIRECTORS of Anaconda Copper recently voted to offer stockholders the right to subscribe for two new shares of stock at $55 a share for every five shares held. The offer is subject to authorization of the proposed increase in capital stock to 12,000,000 shares at a stockholders' meeting on March 14. Funds realized from the offering will be used to provide for the retirement by redemption of outstanding $103,803,000 first consolidated, Series A 6 per cent mortgage bonds, due Feb. 1, 1953, with any excess money to be used for general corporate purposes.

The offer is made to stockholders of record on April 30 and the right to subscribe will expire on June 18. Warrants for the subscription rights will be issued as soon as practicable after April 30. This will leave less than $10,000,000 of the 7 per cent convertible debentures outstanding as the only liability of Anaconda, its subsidiary, Chile Copper, having $35,000,000 of 5 per cent debentures outstanding.

With all of Anaconda's 7 per cent convertible bonds retired by conversion and assuming all Chile Copper Company shares exchanged for Anaconda, there should be 5,412,526 Anaconda shares outstanding. Should all these outstanding shares exercise their rights under this offer, there would be a total of approximately 7,570,000 shares of Anaconda Copper Mining Company outstanding. Retirement of the outstanding 6 per cent Series A bonds results in a saving of $8,000,000 in interest and sinking-fund requirements.

Replying to a question about the future dividend rate, John D. Ryan, chairman of the board, refused to say what the rate would be, but added that to maintain the present dividend rate of $7 a share on the new stock resulting from this offer would require an additional $14,000,000, so that maintenance of the $7 rate would require about $6,000,000 a year in addition to the saving in interest and sinking-fund requirements resulting from retirement of the bonds.

Columbia Steel Corporation Earnings Higher in 1928

Net earnings of Columbia Steel Corporation for 1928 are reported as $1,471,277, which compares with $1,066,399 in 1927. Tonnage volume increased 25 per cent and gross sales 16 per cent. Surplus was increased to $1,870,563 at the end of 1928. During the latter part of the year the corporation began improvements at its steel plants at Terrance and Pittsburgh, Calif., and a tin plate mill with a capacity of 50,000 tons per annum is under construction at Pittsburgh. The corporation owns an interest in the Pacific Cast Iron Pipe Company at Ironton, Utah, the plant capacity of which is 25,000 tons per annum. The corporation also operates a blast furnace plant near Provo, Utah.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78

	1927	1928	1929
January	100.46	97.54	106.86
February	100.01	96.73	110.37
March	100.84	96.22	.....
April	98.63	97.14	.....
May	96.41	99.05	.....
June	95.55	100.16	.....
July	95.42	99.69	.....
August	97.25	99.85	.....
September	96.01	100.53	.....
October	95.36	102.34	.....
November	96.22	103.83	.....
December	98.30	104.28	.....

Mount Lyell in Prosperous Condition

THE report of the Mount Lyell Mining & Railway Company, Tasmania, for the fiscal year ended Sept. 30, 1928, shows net profit of £200,050 ($970,000), dividends of £145,034 ($696,000), and net liquid assets of £641,455 ($3,070,000). This profit exceeds that of 1927 by £26,752 ($128,000). The smelter reduced 37,975 tons of ore and concentrate, producing 15,814,400 lb. of copper, 121,456 oz. of silver, and 2,360 oz. of gold. These totals are greater than those for 1927 or 1926. The new electrolytic refinery was completed, and now the company is self-contained from mine to market. Costs were lowered. Half of the copper is sold in Australia. A fair proportion of the company's profit is from its product super-phosphate, but figures are not disclosed.

Consolidated C. & A. Earnings Totaled $7,770,354 for 1928

REPORT of Calumet & Arizona Mining Company and New Cornelia Copper Company, based on proposed plan of consolidation, for the year ended Dec. 31, 1928, shows consolidated net income of $7,770,354 after depreciation and federal taxes, but before depletion. This is equivalent to $9.22 a share on 842,857 shares (par $20) of stock under plan of consolidation.

Consolidated balance sheet of Calumet & Arizona Mining Company and New Cornelia Copper Company on the basis of the proposed plan of consolidation, as of Dec. 31, 1928, follows:

Assets: Cash, $2,596,243; notes receivable, $73,300; accounts receivable, $4,596,898; government securities, $5,908,358; metals on hand and in process, $1,701,612; supplies, $935,817; investments, $2,449,328; items in suspense, $209,895; mining property, smelter buildings, equipment, after depreciation, $64,129,007; total, $82,600,460.

Liabilities: Accounts payable, $2,226,840; reserve accounts, $183,701; capital stock and surplus represented by proposed issue of 842,857 shares of $20 par, $16,857,140; surplus, $63,332,779; total, $82,600,460.

Natomas Company of California Reorganized

On Dec. 22, 1928, the property of the Natomas Company of California was sold to the reorganization committee of the company formed to take over the assets and by it transferred to the Natomas Company, a new company. The company will issue stock certificates to the bondholders of the old company in the ratio of ten shares of stock for each $1,000 bond. Estimates that Natomas Company has about ten years gold-dredging operation ahead of it have been made.

Current Statistics of Production and Stocks of Copper, Lead and Zinc

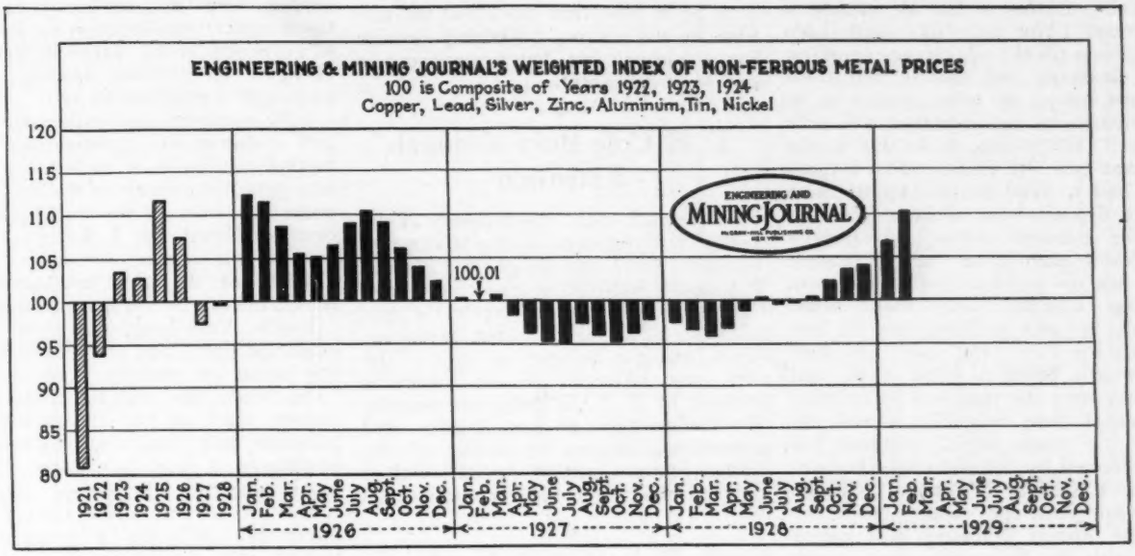
Data from American Bureau of Metal Statistics

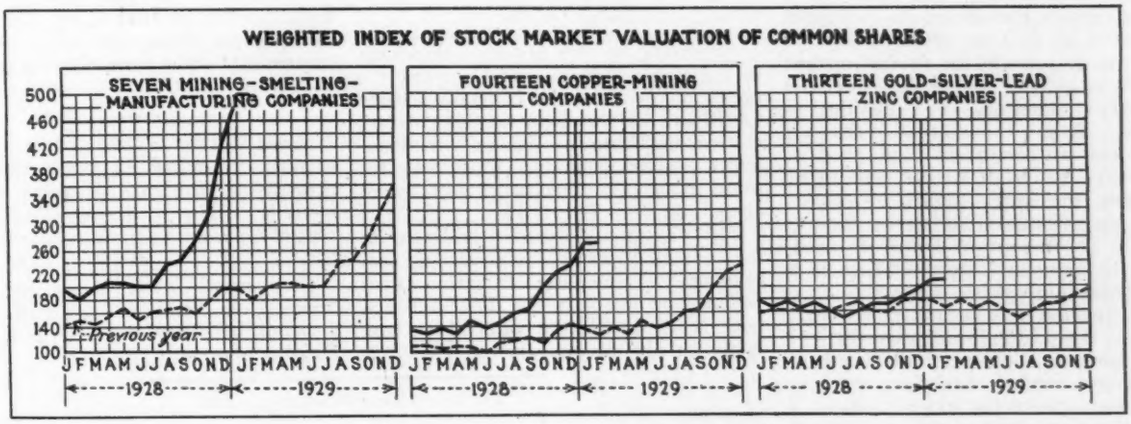
Figures Represent Short Tons

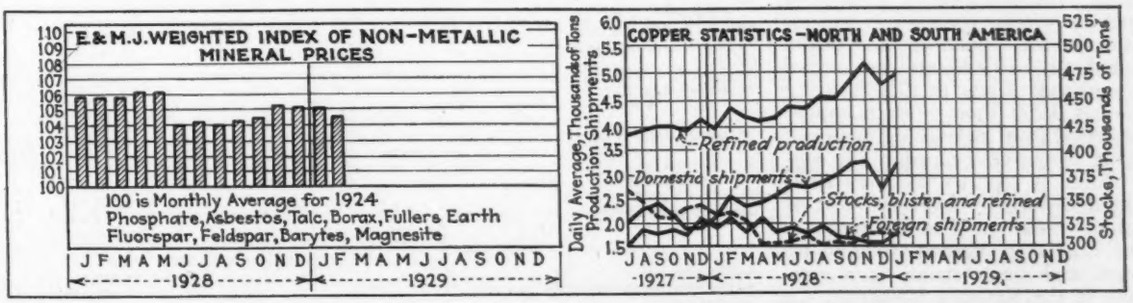
	1927			1928						1929
COPPER—North and South America	Average	Nov.	Dec.	Jan.	Sept.	Oct.	Nov.	Dec.	Average	Jan.
Production, refined, daily average	4,045	3,942	4,159	3,959	4,567	4,813	5,182	4,771	4,448	4,983
Domestic shipments	68,737	59,264	60,862	64,824	88,707	100,371	99,822	84,889	81,955	100,135
Foreign shipments	53,489	52,013	63,637	56,721	51,292	54,992	49,121	49,703	57,185	57,054
Stocks, blister and refined	335,311	324,645	327,478	318,137	290,954	287,380	297,007	315,461	300,771	312,845
LEAD—United States and Mexico										
Production, smelter, daily average	2,513	2,598	2,517	2,479	2,503	2,603	2,821	2,700	2,514	2,653
Production, U. S. mines, daily average	1,798	1,901	1,833	1,755	1,839	1,875	1,934	1,850	1,785	1,900
Imports into U.S.A.	13,451	14,282	10,587	10,418	11,215	15,350	16,935	16,767	12,757	.....
Stocks, smelter and refinery	156,878	155,568	155,280	157,417	155,482	152,746	157,485	161,460	160,511	155,270
ZINC—United States										
Production, daily average	1,681	1,641	1,699	1,691	1,645	1,621	1,675	1,632	1,693	1,604
Domestic deliveries	45,811	44,374	46,483	45,771	44,103	50,126	48,698	49,625	48,301	47,677
Exports, slab zinc	3,468	2,015	1,042	4,644	127	884	714	(a)	(a)	(a)
Exports, ores and dross	4,424	526	2,388	2,444	346	90	114	587	453	.....
Stocks	37,602	39,320	40,751	42,163	47,915	46,068	46,542	45,441	44,333	45,418
World Production Rate (Daily Average)										
Copper	4,543	4,733	4,805	4,631	5,251	5,698	6,127	5,782	5,236	5,745
Lead	4,514	4,579	4,456	4,859	4,950	4,937	5,425	5,265	4,976	5,054
Zinc	3,910	3,988	4,099	4,179	4,182	4,223	4,385	4,426	4,271	4,231

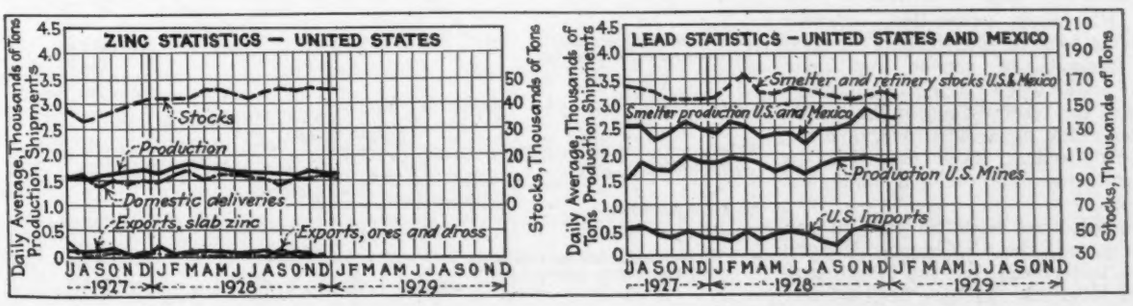
(a) Withheld pending investigation of government reports.

E.&M.J. Statistics of the Mining Industries









London Financial News

By W. A. Doman,
Special London Correspondent

London, Feb. 26, 1929—Copper in Northern Rhodesia still holds the field in mining circles so far as interest is concerned. Not only has there been competition for the advantages resulting from financing and control, but there has just sprung up what appears to be an attempt to make district vie with district. This seems to be due to the fact that two well-known titled persons have had a hand in developing these copper deposits—Sir Robert Williams and Sir Edmund Davis. Presumably they know each other, but at present there are no indications that they are working together, and they would scarcely be seen walking arm in arm through the city. But each has done and is still doing a great work, and each has been the means of circulating millions sterling in one way and another. So much public attention has been directed by Sir Edmund Davis to Bwana M'Kubwa, N'Changa, N'Kana, and Roan Antelope copper properties that Sir Robert Williams now comes along with the Kansanshi mine, which is also in Northern Rhodesia. The Bwana group can boast of a copper content of up to 5 per cent. Compared with the Kansanshi as so far opened up, this is as poor as are the American porphyry producers in relation to Bwana. A fair amount of work has been done at Kansanshi, and most of the assays are from 10 per cent to 43 per cent, the latter figure, of course, being exceptional. Judging by the report of Sir Robert Williams & Company, the company's engineers, it is a remarkably high-grade property.

The question may naturally be asked: why was it not brought forward earlier? The deposit is about six miles south of the Congo border, was discovered in 1899, and apparently extends about 2 miles along the strike, with a width of 600 yards. There is a series of more or less parallel reefs containing various copper minerals. Smelting was begun in a small way in 1908 and was stopped by the outbreak of war in 1914. During that period 3,250 short tons of copper was produced from high-grade reef ores, averaging 18 per cent copper. The copper produced is reported to carry sufficient gold to largely cover the cost of electrolytic refining. The inference is that the Kansanshi deposit, judging by the north and south strike, is a continuation of the Katanga formation. In any case, the mine is different from other Rhodesian properties. Though the public look to the working of such large deposits of copper and their mouths water when talking of the magnitude of the reserves and of the profits to come, they apparently overlook the transport problem. It will be solved in time, it is true, but the long haul is a handicap.

Although they have no part in the financing of the N'Changa Copper mine, I understand that the Harrimans and the Guggenheims have been offered by A. Chester Beatty a participation in the Rhodesian Congo Border Concession, which is also supposed to possess good copper prospects.

According to a rumor the Anglo-American Corporation of South Africa is to reorganize its capital. Half of it is to be in debenture stock and the balance in 10s. shares. Nothing definite has yet leaked out, but a statement is said to be imminent.

T. F. Cole Buys Tonopah Extension

On Feb. 27, 1929, the property of the Tonopah Extension Mining Company, Tonopah, Nev., was bought by Thomas F. Cole for $627,000 at a receiver's sale. Cole paid $290,000 in receiver's certificates, $260,000 in first mortgage bonds, and the balance in cash. The sale was objected to on technical grounds by E. C. Griffith, representing W. Frederichsen, of Los Angeles, and proceedings are to be started in the United States Court of Appeals with a view to nullifying the transaction.

Eagle-Picher's 1928 Net Profit $1,151,177

According to the financial statement of the Eagle-Picher Lead Company for operation in 1928, the company earned $2,381,112 before deducting for depreciation, depletion, or income tax allowances. After deducting $1,229,934 for these items the company's net profit remaining was $1,151,177.

The discontinuation of dividends on the common stock, reported as occasioned by pending litigation over Indian-land leases in the Tri-State district, is reflected in the material increase in the surplus account during 1928.

Profit-and-Loss Account for 1928

Gross sales		$25,997,859
Less: Freight, returns, allowances and cash discounts		1,142,815
Net sales		$24,855,044
Ore and metal purchases	$10,492,911	
Production expenses	8,365,609	
	$18,858,520	
Inventory, Jan. 1	9,200,323	
	$28,058,844	
Inventory, Dec. 31	7,131,907	
		$20,926,937
Gross profit		$3,928,107
Royalties earned	$235,354	
Miscellaneous earnings	70,632	
		305,986
		$4,234,093
Selling expenses	$1,298,312	
Administrative and general expenses	447,320	
Interest paid	107,347	
		1,852,981
		$2,381,112
Depreciation and depletion	$1,147,780	
Provision for 1928 income tax	82,154	
		1,229,934
Net profit		$1,151,177
Surplus Account		
Balance at Dec. 31, 1927		$245,697
Adjustments		73,040
		$318,737
Profit for year 1928		1,151,177
		$1,469,915
Dividends paid on preferred stock	$51,078	
Depletion reserve appropriation	400,000	
		451,078
Balance at Dec. 31, 1928		$1,018,837

National Metal Exchange May Broaden Activities

BROADENING of the market for futures trading in metals to include copper, zinc, and antimony has been taken under consideration by the board of governors of the National Metal Exchange. At present, trading on the exchange is confined to tin.

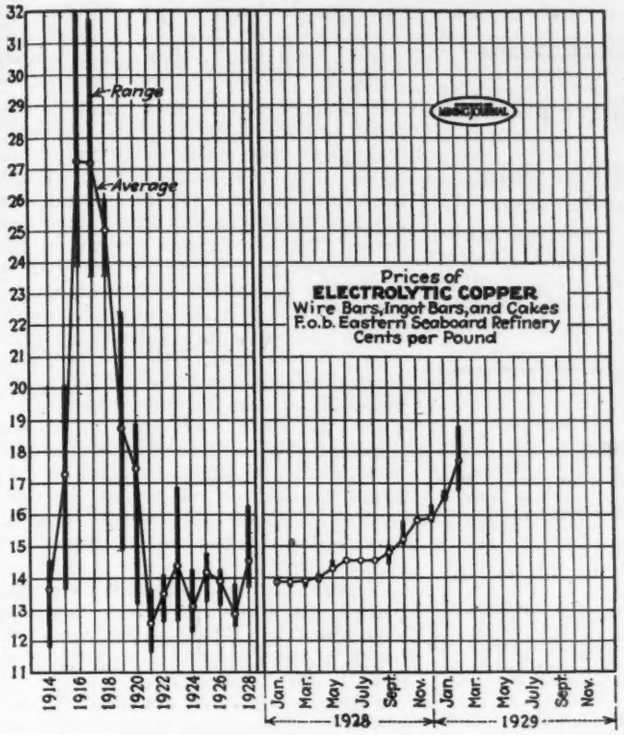
Subcommittees to conduct a careful and conservative investigation of the market conditions of each metal, which may permit eventually of trading therein under the rules of the exchange, have been appointed. I. J. Louis is chairman of the copper committee; C. S. Trench, of the zinc committee, and K. C. Li, of the antimony committee.

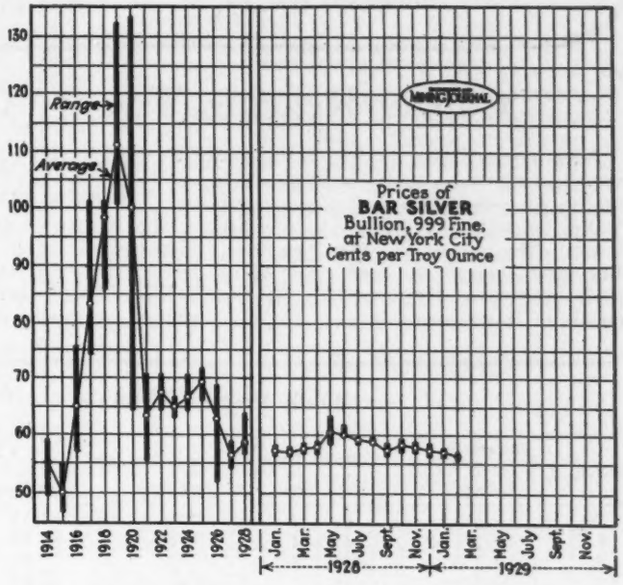
Erwin Vogelsang, president of the exchange, discussing the plan to broaden the scope of trading, said recently: "The board has realized from its inception that in the establishment of adequate and conservatively operated machinery it was furnishing the medium whereby all metals could be traded in to the advantage of those interested. Whereas progress in this respect must necessarily be slow, if it be conducted carefully and with the conservatism sponsored by the board, nevertheless it is felt that within a measurably short time definite progress will be manifest."

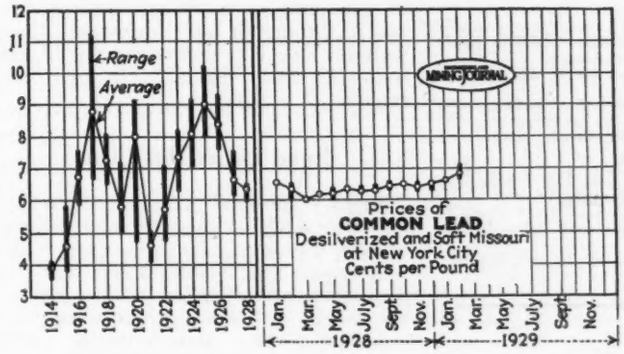
Acme Mines & Mill, Inc., reports earnings from its La Joya quicksilver property at the rate of about $10,000 monthly. The company's stock was recently placed upon a non-assessment basis.

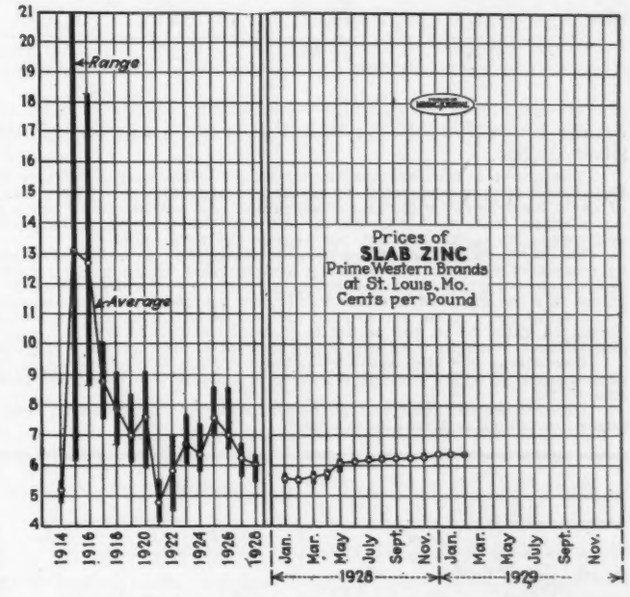
Smuggler Union Mine, near Telluride, Colo., has been reported sold to a group of Denver, New York, and English interests.

Metal Price Curves

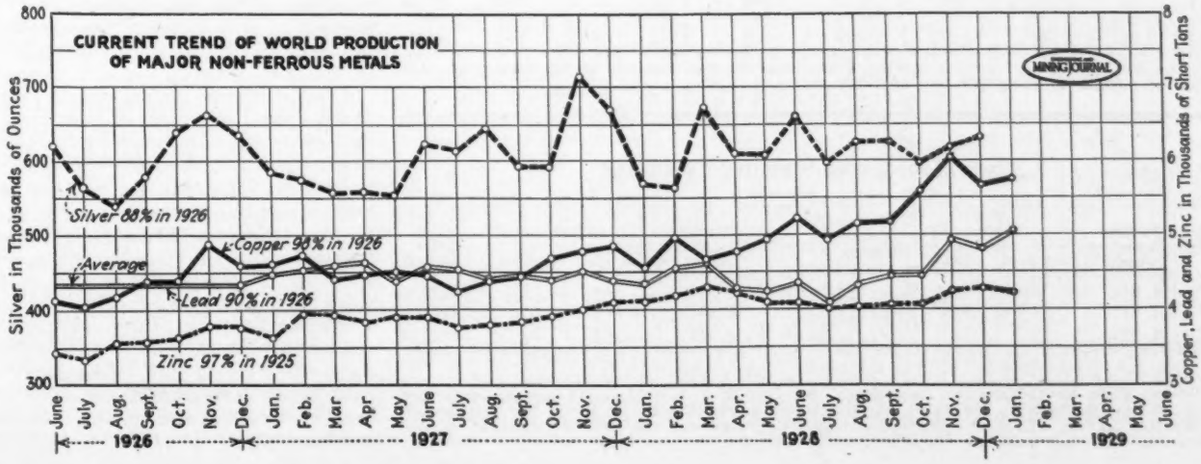








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
Silver in Thousands of Ounces
Copper, Lead and Zinc in Thousands of Short Tons
Silver 88% in 1926
Copper 98% in 1926
Average
Lead 90% in 1926
Zinc 97% in 1925
June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar Apr May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June
1926
1927
1928
1929

The Market Report

Copper Reaches Twenty Cents

New York, March 13, 1929—An advance in the price of copper from 19½ to 20c. per pound, delivered Connecticut Valley, was the only feature of the last week in the non-ferrous metal markets. But little change has been reported in lead, zinc, tin, silver, or any of the metals of lesser importance.

Favorable Statistics Bring Copper Price Advance

The release of the A.B.M.S. copper statistics on March 12 served to inform buyers that the strong position of the producers had been enhanced in February. A strong demand developed in the domestic market immediately following release of the A.B.M.S. figures, and as a result the price in the domestic market was quickly forced up to 20c. per pound. Copper Exporters, Inc., advanced its price to 20¼c. per pound, c.i.f. usual European destinations, effective today.

Producers appear now to have acceded to the demand for July shipment, and opened their books for that position. Sales in the domestic market during the last week have been slightly less that the average weekly sales figure recorded during 1928, the delicate position of the market and the incessant demand being of greater importance in explaining the price advance than the consummation of any tremendous sales volume. Approximately 58 per cent of the tonnage sold during the past week was for July shipment, 24 per cent for June, 10 for May, 6 for April, and 2 per cent for March shipment. This distribution reveals that new business received by some of the larger fabricators has forced them to enter the market for near-by copper, a commodity that is comparatively scarce at the moment.

Export business continues excellent. Sales in the foreign market to date are approximately 30,000 long tons, of which a good proportion was reported today at the 20¼c. price.

February statistics revealed an appreciable increase in daily production rate, but an even greater increase in rate of shipments, so that total stocks at the end of the month were lower than they were on Feb. 1 by approximately 17,000 tons—of which about 7,000 tons was refined.

Daily Prices of Metals

March	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
7	19.275	48.625	7.25	7.15	6.35
8	19.275	48.875	7.25	7.15	6.35
9	19.275	48.875	7.25	7.15	6.35
11	19.275	48.75	7.25@7.275	7.15	6.35
12	19.775	48.375	7.25	7.15	6.35
13	19.775	48.625	7.25	7.15	6.35
	19.442	48.688	7.252	7.150	6.350

Average prices for calendar week ending March 9, 1929, are: Copper, 19.275; Straits tin, 48.792; N. Y. lead, 7.210; St. Louis lead, 7.104; zinc, 6.350; and silver, 56.333.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

March	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
7	82½	83⅞	91	218⅝	220½	23 15/16	24¼	26⅛	26 7/16
8	82¼	83⅝	91	220	220½	23⅞	23 13/16	26⅛	26 9/16
11	82	83 5/16	91	220¼	221⅛	23 9/16	23 13/16	26 9/16	26 11/16
12	81 13/16	83¼	91	218¼	219	23¼	23 9/16	26⅜	26¾
13	85	86⅜	93½	219⅜	219⅜	23½	23 13/16	26⅝	26 15/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

March	Sterling Exchange "Checks"	Silver		Gold London	March	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
7	4.84⅛	56⅜	26 1/16	84s11½d	11	4.84⅛	56¼	25 15/16	84s11½d
8	4.84⅛	56⅜	26	84s11½d	12	4.84¾	56⅜	26	84s10½d
9	4.84⅛	56⅛	26	.....	13	4.85⅛	56⅛	26	84s11½d

Average, 56.313

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Quiet but Firm

Inquiry for lead tempered considerably this week, so that the total volume of sales was hardly up to average. This was in part attributable to six weeks of continuous heavy buying, and in part to the decline in London prices, which began last Friday and continued until today, when a part of the loss was regained. The fact that the New York market is above London parity for bullion lead has taken offerings of Mexican lead off the London market, but no important advance has yet resulted, and it is said that the British Metal Corporation is against higher prices at present. Unless London goes above £24, not much likelihood of a further advance is indicated here.

Lead continues rather scarce in the Middle West, with mixed quotations on desilverized varying from 7⅛ to 7¼c., St. Louis basis. Most of the chemical lead has sold at 7.15c. In the East, the general market has pretty well settled down to the American Smelting & Refining contract price of 7¼c., though a slight premium is occasionally secured on forward business. Two-thirds of the demand has been for March, and about a quarter for April, a large proportion of the orders being for carloads. Foil, cable, and ammunition makers have been well represented among the larger purchasers.

Zinc Holds Firm at 6.35c.

The zinc market has been unusually quiet during the week ending today, only two sellers reporting more than normal demand, and as a result the tonnage reported by these companies amounted to nearly 85 per cent of the week's total. There is no indication of weakness in the established price of 6.35c. per pound, however.

February statistics released by the American Zinc Institute, in tons of 2,000 lb., follow:

Stock, Feb. 1	45,418
Produced	48,154
Shipped	52,952
Stock Feb. 28	40,420
Shipped from plants for export	1,895
Metal sold, but not delivered, Feb. 28	47,223
Total retort capacity Feb. 28	119,896
Number idle retorts available within 60 days	48,581
Average number of retorts operating in Feb.	68,614
Number retorts operating Feb. 28	67,631

Tin Shows Little Change

Tin buying has been no better than fair all week, with prices a shade below the level of the week before. The low since Oct. 13 was registered yesterday—48⅜c.—without bringing any great rush of consuming demand, though more interest was evident, and the price today turned upward slightly. Substantially the same prices are asked for both spot and forward positions.

Silver Slow and Steady

During the last week the silver market has fluctuated within narrow limits and continues quiet and inactive. Moderate buying for India and China account and lack of pressure to sell have been the causes of the extreme steadiness.

Mexican Dollars (Old Mexican pesos): March 7th and 8th, 42⅝c.; 9th, 42⅜c.; 11th, 42½c.; 12th and 13th, 42⅝c.

Foreign Exchange

Closing cable quotations on Tuesday, March 12, were as follows: Francs, 3.90⅞c.; lire, 5.23⅝c.; and marks, 23.72¾c. Canadian dollars, ¾ of 1 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Antimony—Per lb., duty paid, New York: Chinese brands, 9¼c.@9⅜c. per lb. for all positions. Cookson's "C" grade, spot, 14¾c.

Bismuth—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

Cadmium — Per lb., New York: 85@95c. Active demand.

Iridium—Per oz., $260@$265 for 98 @99 per cent sponge and powder.

Nickel—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

Palladium — Per oz., $38@$40. Small lots bring up to $50. Nominal.

Platinum—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $70. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

Quicksilver — Per 76-lb. flask, $121.50@$122.50 cash. Small lots command the usual premiums.

Prices of Aluminum, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Mar. 9.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N. Y.: wolframite, $12@$12.25; Western scheelite, $12.50.

Manganese Ore—Per long-ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian grades, minimum 47 per cent Mn, 30@32c. Market weaker.

Chrome, Iron, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Mar. 9 issue.

Another Advance in Lead Concentrate Price

Joplin, Mo., March 9, 1929

Blende	Per Ton
High	$44.10
Premium blende, basis 60 per cent zinc	$41.00@ 42.00
Prime Western, 60 per cent zinc	40.00@ 41.00
Table concentrate, basis 60 per cent zinc	37.00@ 39.00
Flotation concentrate, basis 60 per cent zinc	36.00@ 38.00
Average settling price, all blende	41.34
Galena	
High	$101.00
Basis 80 per cent lead	100.00
Average settling price, all galena	97.86

Shipments for the week: Blende, 14,106; lead, 1,918 tons. Value, all concentrates the week, $770,840.

Lead concentrate was again advanced in price this week, buyers reporting a basis price of $100. A more recent report from the field today is to the effect that one holder who has declined to sell at less than $105 basis this morning disposed of his lead holdings. Advices from other sources indicate that offerings of $102.50 were received by sellers. The first two advances in price brought out some of the reserve stock, since when the remaining stocks have been firmly held.

No change is reported for any grade of zinc concentrate, either from buyers or sellers. Production was increased approximately 1,000 tons this week, a result of the resumption of operation of some mills long idle. Sellers, through the Allen Sales Agency, offered less than 6,000 tons to the market, which was speedily absorbed, with an additional 6,000 tons from outside sellers.

Platteville, Wis., March 9, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$43.25
Lead Ore	
Lead, basis 80 per cent	$100.00

Shipments for the week: Blende, 645 tons: lead, non. Shipment for the year: Blende, 6,435, lead, 320 tons. Shipments for the week to separating plants, 1,501 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Mar. 9 issue.

Metallic Compounds

Arsenious Oxide (White Arsenic) Per lb., 4c. Market firm.

Antimony Oxide, Copper Sulphate, Calcium Molybdate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Mar. 9 issue.

Alloys

Nickel Silver—Price advanced to 34⅝ from 34¼c. per lb. for 18 per cent Grade A sheets effective Mar. 12.

Yellow (Muntz) Metal—Price for dimension sheets advanced to 25¾ from 24¾c. per lb.; and for rods to 22¾ from 21¾c. per lb., both effective Mar. 12.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten and Ferrovanadium are unchanged from prices in the Mar. 9 issue.

Rolled Metals

Copper—Price for sheets, hot rolled, advanced to 29¾ from 29⅜c. per lb.; and for wire to 21⅝ from 21⅜c. per lb., both effective Mar. 12.

Lead Sheets—Price of full-rolled sheets advanced to 11 from 10¾c. per lb.; for clipped sheets advanced to 11¼ from 11c. per lb., effective Mar. 6.

Monel Metal, Nickel, and Zinc Sheets are unchanged from prices in the Mar. 9 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Mar. 9.

Iron, Steel and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $18.25; basic, $17.50; No. 2 foundry, $17.50@$18.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33@$34; plates, structural shapes, and soft steel bars, per lb., $1.90@$1.95.

Coke—Per gross ton, Connellsville furnace, $3.00. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky, $8; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ending March 9, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	163	148¼	156¼	Mr.29,My.20 Q	1.75
Andes Copper	New York	67½	61½	62½	Mr.29, My.6 Q	0.75
Arizona Com	Boston	5	4½	4½	Ja. 16, Ja. 31 S.A.	0.25
Calumet & Aris	New York	140½	131½	132½	Mr.7, Mr.25 Q	1.50
Calumet & Hecla	Boston	60½	55½	56½	Fe. 28, Mr. 30 Q	1.00
Cerro de Pasco	New York	117½	109½	111½	Ja. 11, Fe. 1 Q	1.25
Chile Copper	New York	118½	105¼	114¼	Mr.22, Ap.22 Q	0.87½
Con. Coppermines	N. Y. Curb	17	15	15¾		
Copper Range	Boston	32	30½	30¾	Mr.15, Ap.15 Q	0.50
East Butte	Boston	4¼	4¼	4¼	Dec., 1919	0.50
Granby Con	New York	94¾	89½	90½	Ja. 4, Fe. 1 Q	1.00
Greene Cananea	New York	185¾	175½	176	Mr. 7, Ap. 1 Q	2.00
Howe Sound	New York	79½	73½	75	De. 31, Ja. 5 Q	1.00
Hudson Bay	N. Y. Curb	22½	20¼	20¾		
Inspiration	New York	65	58	61½	Mr.14, Ap. 1 Q	1.00
Isle Royale	Boston	33¾	30¾	33	Fe. 28, Mr.30 X	0.50
Kennecott	New York	99½	91½	99¾	No. 30, Ja. 2 Q	2.00
Magma Copper	New York	79½	74	75¾	De. 31, Ja. 15 Q	1.00
Mason Valley	N. Y. Curb	1⅞	1½	1½		
Miami Copper	New York	48¾	43½	48½	Fe. 1, Fe.15 Q	0.50
Mohawk	Boston	49½	45	49	Ja. 26, Mr. 1 Q	1.50
Mother Lode	New York	6½	5	5¼	De.14, De.31 SA	0.20
Nevada Con	New York	61½	56¼	58	Mr.15, Mr.30 Q	0.75
New Cornelia	N. Y. Curb	47¼	44	45½	Fe. 1, Fe. 18 Q	0.50
Noranda	N. Y. Curb	64½	60½	61		
Ohio Copper	N. Y. Curb	4½	3½	3¾	Sept., 1926	0.03
Old Dominion	Boston	18	16¾	16¾	Dec., 1918	1.00
Phelps Dodge, old		345½	320	345½		
Phelps Dodge, new	N. Y. Curb	86½	81½	86	Mr. 15, Ap. 1 Q	2.50
Quincy	Boston	49	45½	45½	March, 1920	1.00
Roan Antelope	N. Y. Curb	47	44¾	46		
St. Mary's M. L	Boston	41½	39	40¾	Fe.25, Mr.12	2.00
Seneca Copper	New York	7½	6¾	7		
Shattuck Denn	N. Y. Curb	27½	24	24½		
Sherritt-Gordon	Toronto	9.55	8.95	9.50		
Tenn. C. & C	New York	19½	18½	18½	Fe.28, Mr.15 Q	0.25
United Verde Ex	N. Y. Curb	19½	17½	18	Ja. 4, Fe. 1 Q	0.75
Utah Copper	New York	340	323	335	Mr. 15, Mr. 30 Q	3.00
Waite-Ack.-Mont	Toronto			2.35		
Walker Mining	Salt Lake	3.40	3.25	3.30		
Wenden Copper	N. Y. Curb	2¼	1⅞	2		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	4¼	3¾	3¾		
Amer. Z. L. & S	New York	49	39½	46¼	May, 1917	1.00
A. Z. L. & S., pfd	New York	106½	102¼	105	Nov., 1920	1.50
Bingham Mines	Boston			51¾	De. 20, Ja. 5 Q	0.50
Bunker Hill & S	N. Y. Curb	142¾	139½	142¾	Ja. 31, Fe. 5 X	0.75
Butte Cop. & Zn	New York	9	8	8¼		
Butte Cop. Con	Boston Curb	*94	*90	*92		
Butte & Sup	New York	10¼	9½	10¾	Mr. 15, Mr. 30 Q	0.50
Callahan Zn-Ld	New York	3½	3¼	3¾	Dec., 1920	0.50
Chief Consol	Salt Lake	3.70	3.62½	3.67½	Fe. 1, 1928 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	11¼	10½	11	Ja. 1 K	0.25
Constitution	Spokane	....	....	*37		
Dayrock	Spokane	....	....	1.95		
Dickens Consol	Spokane	....	....	*12¾		
Eagle-Picher	Cincinnati	19½	19	19¼	Mr.31, Ap.15 Q	0.20
Eagle-Pich., pfd	Cincinnati	....	....	102	Jan. 15 Q	1.50
Erupcion	Boston Curb	....	....	*20	Ja. 1, 1928 Q	0.07½
Eureka Bullion	Salt Lake	*82	*79	*79		
Eureka Lily	Salt Lake	....	....	1.42½		
Eureka Standard	Salt Lake	4.50	4.50	4.50		
Evans-Wallower	N. Y. Curb	23¾	21½	22½		
Evans-Wal., pfd	N. Y. Curb	94	90	91½	Jan. 15, I	1.75
Federal M. & S	New York	....	....	301	Je., 1927	10.00
Fed. M. & S., pfd	New York	....	....	107½	Fe. 21, Mr. 15 Q	1.75
Gladstone	Spokane	....	....	*13¾		
Golconda	Spokane	....	....	1.12	Mr.20, Ap.1 Q	0.02
Grandview	Spokane	....	....	*59		
Hecla Mining	N. Y. Curb	23½	17⅛	21	Fe.15, Mr.15 M	0.15
Highland-Surprise	Spokane	....	....	*16		
Jack Waite	Spokane	....	....	*14		
Kootenay Florence	Spokane	....	....	*18½		
Lucky Jim	Spokane	....	....	*17		
Lucky Tiger-C	Kansas City	†5.65	†5.50	....	De.4, De.20 MX	0.12
Mexican Premier	Spokane	....	....	1.24		
National Lead	New York	153½	147½	151¾	Mr. 15, Mr. 31 Q	1.25
Natl. Lead, pfd. A	New York	140	140	140	Mr. 1, Mr. 15 Q	1.75
Natl. Lead, pfd. B	New York	118	118	118	Ap. 19, My 1 Q	1.50
N. J. Zinc	N. Y. Curb	316	311	316		
N. J. Zinc, new	N. Y. Curb	81¾	80¾	81¾		
New Quincy	Salt Lake	1.90	1.82½	1.82½		
Noble Five	Spokane	....	....	*62		
North Lily	Salt Lake	9.25	9.00	9.10	Jan. 20 Q	0.25
Park Bingham	Salt Lake	*10½	*9½	*9¾		
Park Utah	New York	13½	12¼	12¼	Mr. 19, Ap. 10 Q	0.20
Pend Oreille	Spokane	....	....	12		
Rico Argentine	Salt Lake	*44	*42	*42	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	....	....	*42		
St. Joseph Lead	New York	81¼	75½	78¾	Ju. 8, Ju.20 QX	0.75
Sherman Lead	Spokane	....	....	*24		
Silver King Coa	Salt Lake	14.50	14.25	14.50	De. 15, Ja. 2 Q	0.25
Silversmith	Spokane	....	....	*10	Oct., 1926 Q	0.02
Sunshine Mining	Spokane	....	....	1.42	De. 20, BM	0.02
Tamarack-Custer	Spokane	....	....	*44½	Sept., 1924	0.25
Tintic Standard	Salt Lake	15	14¼	14¼	De. 23, Ja. 23 X	0.20
Tonopah Belmont	N. Y. Curb	1¼	1	1¼	Oct., 1925	0.05
Treadwell-Yukon	Toronto	16.50	13.75	16.50		
United Zinc Smg	N. Y. Curb	1¼	1⅛	1⅛		
Utah Apex	Boston	6	4½	5¼	Je. 14, Au. 1 K	0.25
Utah Met. & Tun	Boston	2¼	1¼	2	Dec., 1917	0.30
Whitewater	Spokane	....	....	1.00		
Yellow Pine	Los Angeles	*10	*10	*10	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	9	7½	8		
Barry-Hollinger	Toronto	*32	*28	*30		
Central Manitoba	Toronto	*61	*53	*53		
Coniaurum	Toronto	1.25	1.05	1.15		
Cresson Consol	N. Y. Curb	*95	*91	*92	Jan. 15, Q	0.02
Dome Mines	New York	10⅛	9¼	9¼	De. 21, Ja. 21 Q	0.25
Golden Cycle	Col. Springs	†1.75	†1.72	....	Fe.15, Mr.1	0.04
Gold Hill	Toronto	*7	*6	*6		
Hollinger	Toronto	8.50	8.25	8.30	Mr.8, Mr.25 FW	0.05
Homestake	New York	73½	72½	73	Mr.20, Mr.25 M	0.50
Kirland Lake	Toronto.	1.50	1.40	1.41		
Lake Shore	Toronto	26.75	24.60	24.75	Mr.1, Mr.15 Q	0.20
McIntyre-Porc	New York	23½	22	22	Fe.1, Mr.1 Q	0.25
Portland	Colo. Springs	†*18	†*12	....	April, 1927	0.02
Rand Mines	New York	....	....	36½	Fe. 21, '28 Am.Sh.	1.52
Siscoe	Toronto	1.11	*96	*97		
Sylvanite	Toronto	2.10	2.00	2.00		
Teck-Hughes	Toronto	10.10	9.15	9.55	Ja. 31, Fe. 1 Q	0.15
Tom Reed	Los Angeles	*30	*25	*25	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1	*99	1		
Vipond Consol	Toronto	1.20	1.12	1.15	April, 1927	0.03
Wright-Hargreaves	Toronto	2.40	2.15	2.18	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35½		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	18½	17	17½		
Castle-Trethewey	Toronto	*40	*38	*38		
Consol. Cortes	N. Y. Curb	*20	*18	*20		
Dolores Esperanza	N. Y. Curb	1½	1½	1½	July, 1923	0.05
Keeley	Toronto	*48	*47	*47	Mr.15, 1928	0.04
Mining Corp	Toronto	6.05	5.30	5.40	De.14, De.31 SA	0.15
Montana-Idaho	Spokane	....	....	*9¼		
N. Y. & Hond. Ros	N. Y. Curb	17	16½	17	Ja.16, Ja.26 QX	0.50
Nipissing	N. Y. Curb	3¼	3¼	3¼	Mr.30, Ap.20 Q	0.07½
Premier Gold	N. Y. Curb	1⅞	1⅞	1⅞	De. 14, Ja. 4 Q	0.06
Tonopah Exten	N. Y. Curb	*12	*10	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3¾	3	3¾	Se. 29, Oc. 20 SA	0.07½
United Eastern	N. Y. Curb	1⅛	1	1⅛		
Yukon Gold	N. Y. Curb	*85	*75	*85	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	105½	96½	101¾	Fe. 15, R	1.00
Beth. Steel, pfd, 7%	New York	121	120	120	Mr.4, Ap.1 Q	1.75
Cleveland-Cliffs	Cleveland	150	135	140	Ja.15, Ja.25 QX	2.00
Colo. Fuel & Iron	New York	78¼	71	76¾		
Colorado F. & I., pfd	New York	133	133	133	Fe.11, Fe.25 Q	2.00
Great Northern Iron	New York	34½	32	32½	Dec.15, K	2.00
Inland Steel	New York	95	90	92	Fe. 15, Mr. 1, Q	0.87½
Republic I. & S	New York	100¾	92	93¾	Fe. 13, Mr. 1, Q	1.00
Republic I. & S., pfd	New York	....	....	115½	Mr.11, Ap. 1, Q	1.75
Sloss-Sheffield S. & I	New York	120	118½	120	Mr. 11, Mr.20, Q	1.50
Sloss-Sheff. S. & I., pfd.	New York	....	....	108	Mr.20, Ap.1, Q	1.75
U. S. Steel	New York	189¾	180¾	185½	Fe. 28, Mr. 30, Q	1.75
U. S. Steel, pfd	New York	144½	143	143	Fe 2, Fe. 27, Q	1.75
Virginia I. C. & C	New York	....	....	25	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	....	....	45	Jl.16, 1928 SA	2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	178	168½	175		
Alum.Co.of Amer., pf.	N. Y. Curb	106½	106½	106½	Mr.15, Ap.1, Q	1.50
American Metal	New York	72¾	66	67¼	Fe.9, Mr.1 Q	0.75
Amer. Metal, pfd., 6%	New York	121½	118½	118½	Fe.9, Mr.1, Q	1.50
Amer. Sm. & Ref	New York	122	113	115		
Amer. Sm. & Ref., pfd.	New York	136	135½	135¾	Fe. 1, Mr. 1 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	42¾	38½	41		
Asbestos Corp	Montreal	16	15	15¾	Jan. 1926	1.50
Asbestos Corp., pfd	Montreal	50½	49½	50¼	De. 31, Ja. 15 Q	1.75
Consol. M. & S	Montreal	500	480	486	De.31, Ja.15, SA	6.25
De Beers Consol	New York	....	....	22	Ja. 19, Ja.26,	0.48
Federated Metals	N. Y. Curb	39	36½	38¾		
Freeport Texas	New York	47¾	44	45½	Ja. 15, Fe. 1 Q	1.00
Int. Nickel Can., new	New York	66	60½	61½	Mr.16, Mr.30 Q	0.20
Int. Nickel, pfd	New York	....	....	121	Ja. 18, Fe. 1 Q	1.75
Newmont	N. Y. Curb	221½	210½	218¾	De. 28, Ja. 15 Q	1.00
Patiño M. & E	New York	47¾	41	45	Aug. 1928	4a.
So. America G. & P	N. Y. Curb	3¼	3¼	3¼		
Texas Gulf Sulphur	New York	76	72½	73¾	Mr.4, Mr.15 Q	1.00
U. S. Sm. R. & M	New York	59¾	65½	66	De. 31, Ja. 15 Q	0.87½
U. S. Sm. R. & M., pfd.	New York	56¾	55½	55½	De. 31, Ja. 15 Q	0.87½
Vanadium Corp	New York	109½	101¾	104½	Fe.1, Fe. 15 Q	0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Spokane Stock Exchange, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumprion. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED FEBRUARY 28, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	10/—	10/—	10/—		
Alaska Treadwell (25)	41/6	40/7½	41/—	Nov., 1926	4 (d)
Armayo Mines (25 frs.)	68/9	66/3	66/3	Feb. 1929	5 (o)
Burma Corp (10 rupees)	18/6	16/10½	17/9	Feb., 1929	7 annas*
Bwana M'Kubwa (5s)	22/3	20/9	21/1½		
Camp Bird (2s)	3/3	2/9	3/—	April, 1928	16¾
El Oro (£1)	5/3	4/9	5/—	Nov., 1924	2½*
Frontino & Bolivia (£)	9/—	8/7½	8/9	Jan., 1929	3¼
International Nickel of Canada (no par value)	$66¼	$61	$62½		
Mexican Corpn. (£1)	11/4½	10/—	11/—		
Mexican Mines of El Oro (£1)	12/6	7/6	7/6	Dec., 1926	3¾*
Mount Isa (£)	43/9	41/10	41/10½		
N'Changa Copper Mining. (£1)	89/4½	78/9	85/—		
Oroville Dredging (4s)	3/—	2/10½	3/—	Nov., 1928	31¼
Rhodesian Congo Border (£1)	106/10½	92/6	105/—		
St. John del Rey (£1)	15/4½	13/—	14/9	Dec., 1928	2½
San Francisco Mines (10s)	25/7½	34/7½	35/—	Jan., 1929	25
Santa Gertrudis (£1)	11/—	10/4½	10/9	Jan, 1929	7½
Selukwe (2s. 6d.)	7/6	6/9	7/—	April, 1927	6¾
S. Amer. Copper (2s.)	3/1½	2/10½	3/—	Nov. 1917	75
Tanganyika (£1)	71/3	67/6	70/—	July, 1928	5
Union Miniere de Haut-Katanga (Brussels)	12,350	12,150	12,275	July, 1928	182.60‡

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.

(Price quoted in dollars with a fixed rate of $5 to the £1)